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FEBRUARY 1977
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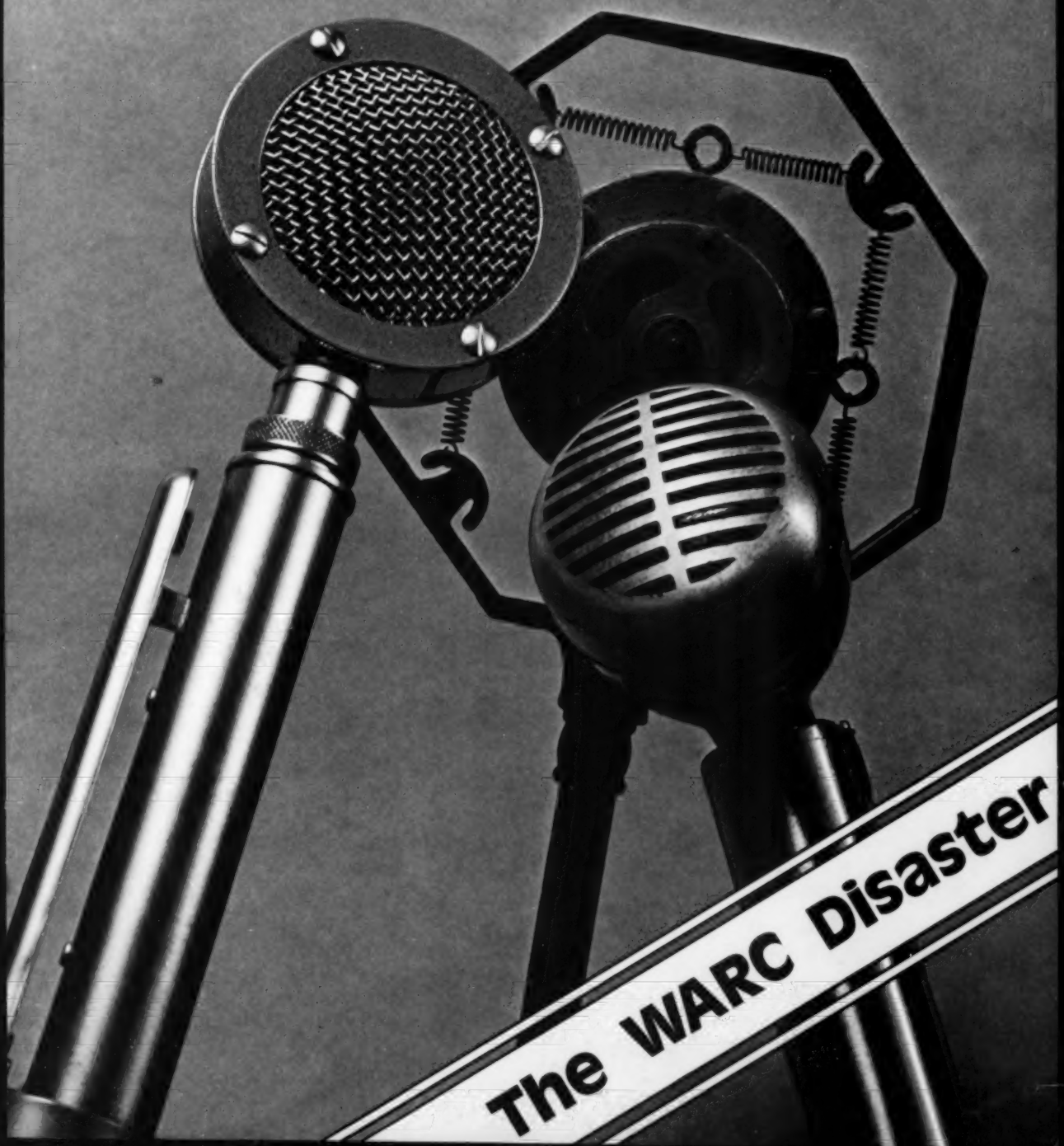

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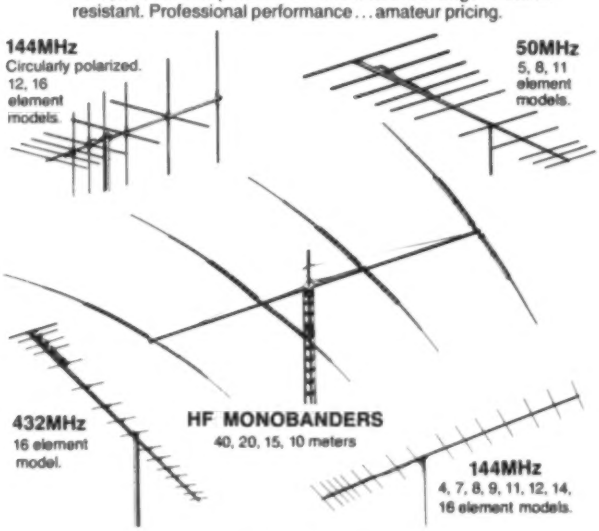

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COVER: Some of Wayne's microphones. Photo by Ed Crabtree.

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NEVER SAY DIE

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

ARRL REPORT

Well, here comes Wayne Green bad-mouthing the League again ... right? Right. This time it has to do with a letter from *QST* (which many of our readers have been forwarding) which asks why authors are not writing for *QST* any more.

I think I can answer their letter ... perhaps better than many of the readers who got it. I'll try to do it without being sarcastic or nasty, which (you know) has to be a major effort for me.

The ARRL has set itself up as the representative of amateur radio. While many of us realize that this is largely fiction, the image that ARRL must project to maintain this fiction is one of service and infallibility. This image has been getting pretty tacky of late, particularly with respect to any correlation between promises made by League officials and performance in the WARC situation. The decision by *QST* to stonewall the situation has disillusioned tens of thousands of amateurs and has, in a large part, I believe, been responsible for the loss of interest on the part of both the subscribers and writers in the magazine.

I think all of us would feel a lot different about *QST* if we knew that the ARRL was fielding teams of ambassadors to the Third World countries to sell the concept of amateur radio so that we would have some votes to back us up at Geneva. There is still time for this – but *nothing* is happening!

The recent FCC revelation that much of what ARRL had been telling us in *QST* about possible new ham bands was just hot air hasn't helped the ARRL image at all. We don't like being lied to.

The Board of Directors of the ARRL Foundation had the right idea ... they wanted to get the League to stop talking and *do* something about the ITU frequency conference. Their efforts to get money from the League for this purpose failed, so then they went about setting up a fund drive to get money so the Foundation could act. When the ARRL refused to even let them do that, the board resigned in protest ... en masse. Can you even think for a moment that hams such as Bill Eitel and Pete Hoover don't know how serious the ITU situation is and how desperate the need for immediate action is?

When amateurs regain confidence in the League, I think we'll find plenty of authors submitting articles. Authors want to be proud of where they are published, not ashamed. As soon as amateurs feel the League is being honest with them and doing the job they claim they are doing, there will be articles and subscribers.

The recent election of ARRL directors was a particularly sorry spectacle. One director was replaced by a new man ... all the rest either ran unopposed or else won their elections ... every last one of them. This indicates to me a massive apathy on the part of ARRL members. While the directors have very little to do with running the League, they are the only ones who can make any major changes in the people who are running the League and who are letting amateur radio, as we know it, go down the tubes.

I'll tell you this ... if ARRL convention program committee chairmen have any sense, they won't ask *me* to come and talk. I have no good news as far as WARC and the ITU are concerned. I do have a lot of inside information, but there is none that you really want to hear. The League knows this just as well as I do, but I know they are far more interested in spending $800,000 on a new wing for the HQ building than trying to protect our bands. I just happen to think that the rainy day the ARRL saved up that $1 million they have in the bank for is here.

Hmmm, I didn't realize I was so steamed up over that. Sorry if I came on stronger than I intended.

Congratulations to Don Miller W9NTP for winning the Central Division directorship of ARRL. Don is one of the authors of the SSTV book ... not the long-forgotten DXer. Congratulations, too, to Gay Milius W4UG for winning the vice director's spot in the Roanoke division. With those two exceptions, every ARRL officer held tight, so we're probably headed into two more years of inaction.

If a director or vice director comes to your club for a visit, put him on the spot and ask him to tell you what happened with the ARRL Foundation ... he knows full well about it, if he'll level with you. Ask him about the money that has been spent from the $100,000 fund to protect amateur radio ... he also knows exactly how that has been spent and why not one word of it has ever been printed in *QST* or even leaked in the ARRL annual report. Start asking questions, so you can get to know your League and perhaps push for some serious reforms.

FLY THE FLAG

It really got home to me a few years ago when I began traveling. Until I had had a chance to visit other countries and talk with the amateurs there in depth, I really hadn't understood some of the profound differences between the opportunities we have here in the US and the problems people face in other countries ... just about *all* other countries.

While I am not now much on owning things, back in the late 50's, while I was editor of another magazine ... possibly one which you are unfamiliar with ... I was single and had quite a few hobbies up and running. There was my Arabian horse which I spent several years riding and training ... a Chris Craft express cruiser for water skiing and boating trips ... a two-place seaplane ... and not one, but *two* Porsches. On the hamming front, I had a 75m kilowatt, an all band kilowatt, and a 2m kilowatt ... all homemade ... an amazing amount of RTTY equipment ... and I was putting out a monthly RTTY bulletin to about 2000 subscribers. As I said, I was single.

When I visited other countries, I would occasionally find someone wealthy enough to own a plane ... or a boat ... or a sports car. But it took enormous wealth to be able to afford all these things at once ... it was just totally beyond possibility for all but a very few. Since I was not making a lot of money and I was able to afford all those nice toys, it emphasized the difference in opportunity between countries. Not many of us are energetic enough to try and do all those things at once, but if we want to, it isn't that difficult to do. It is *our* choice.

Though we have a lot of problems with our courts, with our government, with big business and the other power structures, in all we have a lot more opportunity here than our counterparts have in other countries ... and I've visited almost a hundred of them now.

Perhaps I'm off base, but to me, despite the harassment I've had from our courts, government, and big business ... and they've each done fantastic jobs on me ... I think the United States is great and I am proud of the good things that people are doing. Just think of it ... despite two hundred years of the worst things that the courts, government, and business could do, the spirit of the nation has come through and triumphed. I say

Continued on page 27

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You probably have considered purchasing an all-mode, 2-meter transceiver, but figured that you couldn't afford one. Figure again! Kenwood has lowered the price of the fabulous TS-700A, making it much easier to get on the 2-meter band with a top quality all-mode VHF system. At its new low price, the TS-700A is certainly the "Pacesetter" in both price and performance. And it's ready for immediate delivery . . . in fact, your dealer probably has them in stock right now. There's a lot of excitement on 2 meters . . . not only on FM, but SSB and CW too.

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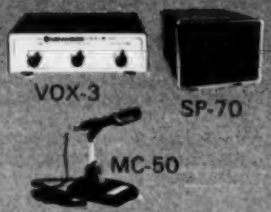

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BE MY GUEST

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The Lady in the Harbor

It is simple to write about the amateur radio happening on Liberty Island NY, on the four day Thanksgiving holiday, 25 to 28 November 1976. How did it happen? It was the brainstorm of "Doc" Lew Levitt WB2NDI, Kings County Radio Club, Brooklyn NY. "Wouldn't it be nice if amateur radio could be treated to an event similar to Op-Sail '76 to celebrate the Bicentennial?" Getting the idea into reality took months of concerted effort by lots of people. The actual event, the four days of glorious activity, was the climax of some anxious times. Doc brought his idea to the Hudson Amateur Radio Council (HARC), where he proposed that it take on the big job of organizing, coordinating the preliminaries, and then operating WL2USA. What follows will describe the nitty-gritty of getting the idea into reality – the many hours of planning, letter writing, and telephone calling. Most of the work was done in the morning before work, and in the evening after work. There were some unavoidable interruptions during regular working hours, but these were kept to a minimum.

The value of this narrative lies in showing that anyone who takes on anything worthwhile to do, for the first or for the millionth time, will find that there is going to be lots of lost motion, lots of frustration. If it comes off, in spite of all obstacles, you will honestly come by a sense of gratification and achievement that no one can take away from you. This will give you confidence to go on to even greater and higher goals. When Doc Levitt came to HARC and made his proposal, it was very clear that it might be a tough assignment. Then why did I take it on? It was complicated enough to be interesting.

Problem Number One: In order to get a permit from the U.S. Department of Interior (National Park Service) to put on a special event on Liberty Island NY near the Statue of Liberty, an applicant must agree to observe the regulations that are in force. Most are simple housekeeping ones, others regulate the limits of the activities, and others say no camping, no fires. We set out to find a way to get around the regulation about camping and structures. The solution was obvious – so we thought. Thus very early in the game, we became our own worst enemy. We learned a lot in a short time about negotiations with U.S. Government agencies. It was bad enough dealing with the FCC for the special call. Doc Levitt is one of the most persistent persons around, and, thanks to that, the special call was issued, but not until after months of waiting, griping, calling (but mostly waiting and waiting some more). We decided to "go to higher authority" for exemptions to permit us to erect structures. After all, an antenna *is* a structure! The whole project nearly folded then and there. For future reference, anyone dealing with the U.S. National Park Service should remember this: The U.S. Park Service rigidly adheres to the "captain of the ship" policy. It is an enviable policy, in that it maintains authority and responsibility in the field. The best qualified to make a decision is on the scene, and the decision is made on the spot. It has proven to be very effective. It was our tactical error to try to circumvent the authority of the Superintendent of Liberty Island. Once we accepted the stringent restrictions, we found that he was also prepared to go out of his way to extend the help he was authorized to give. We became very good friends. Without the Service's kindness and help, we would not have been able to take our gear, set up for four days, and operate at all. From the very first day (during our site visit), they gave excellent advice and suggestions on how to prepare for the worst. They even made storage facilities available. We had access to the maintenance shed for inclement weather and contingencies, where we could set up at least the 2 meter, 20 meter, and OSCAR station. To Mr. Luis Curbelo-Garcia and Mr. Dean Garrett, many thanks. Moral: Find out very early. If you can't fight 'em, join 'em . . .

So a month before the event, we had the site. It was also three weeks before the HARC Convention at Great Gorge, and the convention committee had more pressing matters than worrying about li'l ole WL2USA. We got individual help, but in general we were on our own.

Most of you who went to the HARC Convention saw how we tackled Problem Number Two: How do you motivate people to go out into the cold, get on a subway, buck the crowds (while lugging a rig), ride to the tip of Manhattan, dress for the rigors of wind and spray, and stay for at least four hours? It wasn't easy. You set out to get as much help as you can, from anyone, and from anywhere. Keep in mind that the impetus has to come from you. It can get lonely. How persuasive was the blurb in the Convention program book? It was a flop. Two live takers came from it: Stu K2RPZ and Harry WB2FZE. They said they would come, because they knew what it might be like, but since they were well-weathered fishermen, they could hack it, no matter what! I wish there had been fifty more like them! Then I went to the DX session moderator to sneak time before the regular sessions to drum up more takers. No luck from that tack. The weekend before the event, we had to go the Island to conduct field tests, and literally test the water. Doc Levitt met us with his two meter FM rig, and we took our SBE 34. The purpose of going was to find out what loose ends were left, what had to be revised, and what it was going to be like. It was miserable, damp, and windy, and my rig didn't work. We were off to an inauspicious start, indeed . . . We also had to find out where to plug in the extension cords, where to find the johns, how to set up a mast and guy it according to regulations and for safety, where to get a snack, and where to thaw out. I was chilled to the bone, and three days later the ache was still there.

From left: Wally WA2NVG, Arnold WA2CID, Carlos WA2AUV, Allyn WB2ZKZ.

Would the four day stint do me in?

Father Vic W2IJC called long distance from Rensselaer NY for information and details about WL2USA. We made a sked for 3850 kHz. With John W2BPU in Teaneck, and Don WB2VJC on the side in Rensselaer, Father Vic said he would come. Things might be looking up. On the day before, the roster included Doc WB2NDI, Allyn WB2ZKZ, Larry WB2TXL, Paul WB2CNF and Ed WB2UDD. So on Thanksgiving morning, we loaded up the VW Rabbit, checked the ropes on the roof carrier to see if the antenna masting was secure, gassed up, and went down to the back of Midas Muffler to find old muffler clamps for the antennas. Then it was down the Jersey Turnpike for the Holland Tunnel and the Battery.

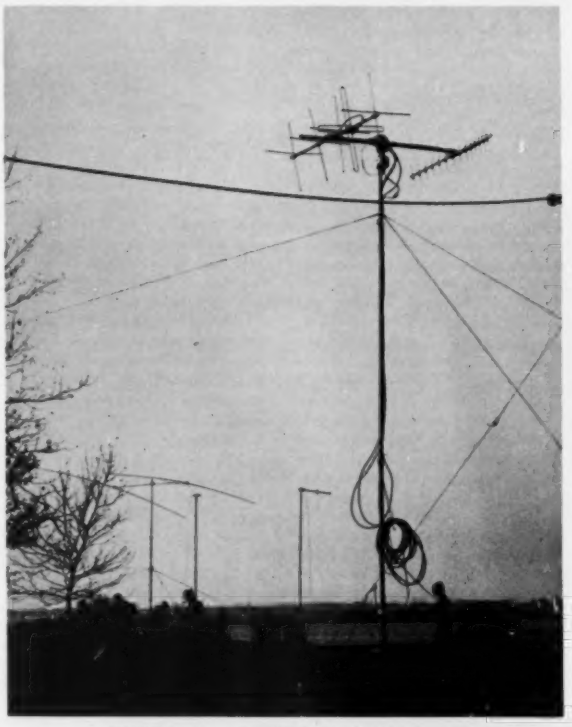
Liberty Two, the U.S. National Park Service bumboat, pulled up to the dock. We were waved on by the sentry to the Coast Guard parking lot adjacent to the Marine Inspection Office at the Battery. This was another example of how far the Park Service went to extend their help. There is very little parking in the vicinity of South Ferry. What there is, naturally, is expensive. More importantly, we needed access to the dock to offload our masting and gear. This was a very generous act. More on parking later.

The skipper of *Liberty Two*, I found, was a signalman on the *USS Utah* at Pearl Harbor. He and I must have been a few hundred feet from each other during the war years. My activities as a civilian radio operator on the tugs and dredges took me into the same areas of the Navy Yard. It took over thirty years and several thousand miles to find out about each other. This brings up another point: You can expect to discover new things and meet lots of nice people when you set out to do something worthwhile. I am sure the skipper would have been just as helpful otherwise, but it was still awfully nice to be aboard a tug again, feel the vibrations of the engines underfoot and the spray on my face again! Then, to take me all the way back to those days, he let me use the FM rig aboard *Liberty Two* to inform the acting superintendent of Liberty Island when we got underway!

As operations go, most of us have been on field days much more elaborate than WL2USA. First of all, we were limited by the rigs that could be brought conveniently. *Liberty Two* had very limited space and storage. At no time were we in full operation simultaneously on 20, 40, and 80 meters. We set up the best we could with what was brought in rigs and in antennas, commencing at 8:00 am, and we made our first contact on 20 meters at 12:15 pm with Harvey WA0QBY in Missouri. We made our two meter contact a little earlier at 11:25 am, through WB2UDD's five Watt FM rig, with Steve WA2OHF. It was a cold, overcast day, and even at the slowest exposure the colored film did not give very good pictures. Ernie WA2HLY did the best he could with his camera. He loaned them to me for photoreproduction to black and white 8x10's. As you can see, we set up near the flagpole opposite Ellis Island and the Battery, with the 20 meter beam set into a flag stanchion and then guyed ten feet above the ground (to avoid scalping anyone). We used the armstrong rotator if we needed to. Considering everything, the two element beam did very well into Europe and nearly got us WAS. We missed by about six states, and Father Vic, bless him, got us Nebraska! Our 80 meter antenna was a home brew helically-wound vertical. Allyn WB2ZKZ and myself made it in a couple hours in our backyard QTH.

The showpiece of WL2USA was the OSCAR station that Art W4ART brought up from Arlington VA. Art was my other live catch from the HARC Convention. On the basis of the showstopping OSCAR demonstration at Great George, Art decided to come up to New Jersey and spend Thanksgiving with his family. He gave me a lot to be thankful for, too! With Art came Murphy, in spades. We set up the OSCAR station on Thursday, but missed all the passes for that day. It would have been nice, but it was asking too much to be able to set up in an hour to get the morning pass. Art had run out of gas and barely made it to the parking lot, and on a Thursday holiday afternoon we would not have found a gas station open for business. So we left his van in the lot overnight.

The next day, Friday after Thanksgiving, is a regular working day for the U.S. Coast Guard. Shortly before that, Art had found a badly damaged 432 MHz transceiver. It was clobbered – it hit so hard that the impact had sheared the mike plug plastic insert and bent the gain control shaft. I had personally put the station away. When I closed the storage shed door, I must have pushed it off the top of the pile onto the floor. As luck would have it, he had borrowed it! I thought Art would pack up and go back to Virginia ... Not two minutes later, while I was still breathing hard, Dean Garrett came over with crisis number two: "You'd better call Chief Dick pronto. He is good and mad, since he's just been chewed out by the E-X-O for allowing an unauthorized vehicle of another governmental agency to park with tags marked W4ART." I think that's what may have saved me. Art had left his FCC identification in the car, too, and I couldn't get up enough nerve to tell the Chief that W4ART was not a government license plate. The other reason that I might have been saved was that there were other things going on. It must have been close to noon when I called back to apologize. The Friday after Thanksgiving had gone well, and the Chief allowed us to park there for the rest of the day – as well as Saturday and Sunday! He could have scuttled WL2USA and me too if he had barred us from parking. When it rains, it pours ... but we were actually spared on that score. The weather for the four days was nearly springlike. So the blurb had done too good a job, and scared everyone away. We made 33 contacts with OSCAR on orbit numbers 9295A, 9307B, 9308B, 9320A. Amateur radio, public relations, the United Nations, the UN Meditation Group, the Bicentennial and the Statue of Liberty achieved Unity with the Universe in the middle of orbit 9307B at 1459 UTC. Art W4ART was explaining the OSCAR station to a member of the UN public information staff. Bernard Curchack from the UN Meditation Group had also come to Liberty Island to give thanks and pay homage to the Bicentennial. Unfortunately, the park authorities, in deference to WL2USA, refused permission to them. So it seemed the gracious thing to do to let Bernie read his poem of praise (panegyric) on OSCAR! It was, for all observers, a very emotional event. This was a very unique event indeed! While all of WL2USA was a noble undertaking, this particular event was transcendent and mystical. It made all the effort worthwhile. So on Sunday, when Father Vic came aboard, he put the topping on the affair by representing the clergy and our freedom of belief and conviction.



WL2USA antenna farm (Ellis Island in background).

The other circumstance that made WL2USA memorable was the cultural and ethnic mix. We had the WASPs, Jews, Afros, Hispanics, and people of Asiatic ethnic origins. All there to honor America by means of amateur radio. What other time would you expect two radio amateurs, Allyn WB2ZKZ and Carlos WA2AUV, to limber up after a stint at the mike with the ancient Chinese t'ai-chi? No way, no how – gung ho! Allyn is one half Chinese, and Carlos, Hispanic. They were all very decent fellows, full of enthusiasm, very competent. They will go fair and far. The other visitor from the Quisqueya Amateur Radio Club, Bronx NY, was Arnold WA2CID. Of all the calls for any Hispanic to get! El Cid of Charlton Heston fame is the national hero of Spain and the cultural superman of the Hispanic culture, and apparently it had not occurred to Arnold that this was the case. He was most delighted to be told this by me. We made as many DX QSOs as the number of operators (about three dozen), including Pete WB8NAS/1 and Sally WB8NOK/1, Luis HI8LMK/W2, Irene WA2LWG. The other radio club that sent operators was from St. Peter's Prep (K2OQJ) – Bob WA2DMF, Taras WB2ERD, Walter WA2ZNW. Paul WB2ZNF, Englewood NJ, was our statistician. According to him, WL2USA made a total of 1142 QSOs. Two meter FM accounted for 560, and the low band for 549. Limitations of time and coverage kept others from a QSO with us. If you feel you deserve a QSL for your effort, send a QSL card, tell us the time you tried, what you heard, and whom you heard, and we will send off the QSL to you as a souvenir. All who contacted us and were confirmed will, of course, receive the commemorative WL2USA QSL. Designing the QSL is a story in itself.

Whenever you set out to make a QSL card, you are making an esthetic statement. For me, it requires a lot of introspection and sober thought. In this case, we had to epitomize the spirit of the project. Some of the people I asked suggested we do it whimsically. Why not the Statue of Liberty holding a tribander beam? No – too frivolous. I recall the anguished responses when someone suggested a red, white and blue sash for the

Lady in the Harbor. Once committed to a matter-of-fact, straightforward treatment, the matter becomes somewhat easier. When Larry WA2FSY and Roz WA2EMC heard about the idea, Larry gave me a photoreproduction of a woodcut of the Statue. Then, to be authentic, should we include the Emma Lazarus quotation about the tired, poor and huddled masses? So a call was made to Dean Garrett and by return mail came a picture of the tablet in memory of Emma Lazarus. It is in Gothic sans serif type, cast in brass and located in a place of honor. An entire QSL card in Gothic sans serif just didn't seem to look good, nor did all italics or Roman. What to say, and how to say it? My tentative designs were shown to my artist friends, who were very helpful. Finally I went to the Suburbanite in Englewood to see Jules and Richard Jacobson. We went to the photo font machine and chose italics and Roman. The next day the Audio-Visual Department made me a 3¼ x 5½ inch negative for the QSL card and a 8½ x 11 transparency for transvue projection. Those who went to the DX sessions at the HARC Convention saw that result.

Again, there is more than meets the eye. In order to legitimately display the NYC Bicentennial logos, we had to get permission from Dr. R.L. Gaudreau, Executive Director of the NYC Bicentennial Corporation, the same outfit that brought you Op-Sail '76. Then, to get permission for the American Revolution Bicentennial logos, we had to write to the NY State Bicentennial Commission in Albany. Then, and only then, with the endorsement and approval of the U.S. National Park Service, we got permission to use the logos. This gave the DXpedition an exalted status, and you might say amateur radio had its own Op-Sail '76! Why not? This is why the U.S. National Park Service put out the red carpet to us.

Those who went to Liberty Island did amateur radio proud. They were worthy representatives of amateur radio. Without being self-conscious, they furnished the Voice of the Statue of Liberty and gave to a very limited segment of the amateur radio population of the entire world an opportunity to share with us our pride and joy in the Bicentennial. We have to tell you how seriously Joe W9RCJ took the matter. He finally called me at home in Englewood to ask if we were on the air and could we please sked him for 11:00 am on Sunday. Joe, you get the card as soon as Stu K2RPZ gets the negative from me and runs off the 1500 cards we need. There was no need to send an SASE, either. Then we must give Carlos WA2AUV the atta-boy award for trying hard. As we were getting on the ferry to get back to Manhattan for the last time, running down the gangway was poor Carlos, who had missed the one before and was trying to get there to help us out. Better luck next time, buddy . . .

So how about next time? Would I ever do it again? What could we do differently to make it better? What did we get out of it? We would do it again, emphatically! It was a once-in-a-lifetime chance to really do something worthwhile for ourselves and for lots of other people. As it turned out, the gods were kind, and the weather did not turn foul until the Monday after Thanksgiving. You had to dress for it, and be prepared. Different would mean just more lead time and less competition with a long holiday — and more planning ahead. This would assure more operators and transmitters and more opportunities to get QSOs. There is no way to make WL2USA a 24-hour operation without an act of Congress or some very special dispensation from the U.S. National Park Service.

Finally, what did I get out of it personally? Something rare. I got a chance to get to know myself, and what I saw I liked. To carry the ball for an event that goes beyond the boundaries of time and space, to show your pride and convictions and use state-of-the-art technology in the way and place we did it in the way we did it, is something I will be able to recall with pleasure for a long time to come. I hope others that came with me feel the same.

Wally Luke WA2NVG
51 Tenafly Road
Englewood NJ 07631

I/O– a 5 Year Forecast

The general purpose computer industry has a better future in the United States and overseas than previously estimated, according to the Arthur D. Little consulting firm.

The installed base of computers should grow 9 per cent compounded annually in the US and 12 per cent overseas through 1981, the firm said in a recent report.

In its 15th annual five year forecast of the industry, ADL said International Business Machines apparently has recovered from its weakness in its share of the computer business and may become a greater threat to other computer makers.

Increasing profit margins for computer manufacturers also are forecast in the report by Frederick G. Withington and Oscar H. Rothenbuecher of the ADL staff.

Large general purpose computers are not about to be displaced by smaller minicomputer networks, the study said.

Computer shipments will rise rapidly as manufacturers continue making them easier to use, the study said.

Other reasons for the optimistic outlook include "the burgeoning of electronic office and funds transfer systems and the growing use of computers to offset inflation in labor intensive industries."

The installed computer base in the US should rise from about $46.5 billion at the end of this year to $70 billion to $75 billion, and from $40.9 billion overseas to $70 billion to $80 billion in 1981, the study said.

US manufacturers will maintain their dominance of the worldwide market, though it will decrease from 75 per cent this year to 67 per cent in 1981, ADL researchers said.

"The strongest competition for the US computer industry will come from Japan," the study said, noting that country "is making impressive strides toward an integrated, export-oriented industry" and is making inroads in western Europe.

Wider profit margins for computer makers should come from major decreases in manufacturing costs and new revenues from selling systems programs separately from the machinery.

Looking beyond the next five years, ADL says minicomputer networks may become more popular than the huge general purpose machines, though "the two types will live side-by-side for years to come, with most networks requiring a large central host machine.

"The big general purpose machines have a 20 year head start on systems programs," said Withington.

"Small computer networks are not likely to be able to offer equivalent convenience, versatility and stability until the early 1980's. After that the dominance of large computers may wane, but an 'Indian summer' of growth and profitability for them appears likely in the interim."

Reprinted from the Nashua Telegraph, *Nashua NH.*

A Ban on Linears?

If you've been wondering what effects CB is having on ham radio, wonder no more. The plague of outlaw SSB CBers may force an end to the manufacture of linear amplifiers, bring point of sale license checks, and FCC approval of all commercial equipment.

Those are the main points of a staff recommendation due before the FCC at year's end. Chief Engineer Ray Spence, in a *73* interview, said the ban would cover all linear amplifiers, not just those intended for use by CBers. Spence also said he hoped to avoid a ban, by adopting rules requiring dealers to check if a buyer is licensed to use an amplifier. Dealers could be held responsible, and face fines, if they sold to unlicensed persons. Already federal law bans the sale of amplifiers for CB use, but the first conviction under the two year old statute did not come until October. In that case, a Florida CB dealer was fined $250. Legal loopholes, forced by other services, have allowed continued manufacture of the banned amplifiers. The way the law stands, any unit capable of frequencies other than 11 meters is legal, but it's quite obvious what the gear is for, when you consider the 27 MHz receive preamps built into most of them and the 4 to 5 Watt input power. In light of these latest developments, it looks like ham radio may lose more than 11 meters to the CBers. FCC officals emphasize that they have tried everything they can think of to slow down the CB outlaws. Field Operations Bureau (FOB) personnel report illegal activity, despite well-publicized raids in several major cities, is on the rise, not the decline. (In Houston TX, a group of 10 SSB CBers were shut down, revealing the same pattern encountered elsewhere . . . ham transceivers and linear amplifiers modified for 27 MHz, big beams, and enough interference to other services to fill a new BCI-TVI-RFI handbook.)

Engineer Spence, himself an amateur, finds the idea of banning the manufacture of amplifiers "appalling." "It may end up a combination of the alternatives," Spence said, "with equipment approval and point of sale checks becoming law." Others at FCC see no alternative but a ban on amps. The irony in all this is that FCC's attention to the outlaws will only further delay, if not kill altogether, proposals for non-code licenses . . . proposals the outlaws claim they are working for by defying the law. In each issue of *SSB News*, a newsletter devoted to HF and VHF pirates, the editor states, "*SSB News* does not advocate defiance of FCC rules, but we do believe the FCC should act to provide for the needs and wants of the people, to designate additional frequency space on the 11 meter band for sideband hobby operation, and to make a Novice license more appealing by allowing sideband phone privileges for Novices on 10 meters!" (His exclamation mark.)

FCC officials say Class E CB (220

Continued on page 11

DIGITAL PERFECTION NOW

ICOM recently introduced the revolutionary new **IC-211** 4 MEG All Mode transceiver with dual tracking, optically coupled VFO's: just the first of a great new wave of ICOM LSI synthesized radios. And now the **IC-211** is joined by the amazing **IC-245** mobile transceiver. Together they herald the beginning of the ICOM VFO Revolution.

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LETTERS

ADAM'S RIB

I am not a ham. Now, wait; don't all of you start jumping on me with both feet, at least not yet. I am one of an ambiguous group known as short-wave listeners, among other things. I have been a (dare I say it?) CBer since 1957 when that endeavor had just been born. Perhaps I should say that it was an Eve drawn from an unwilling Adam's rib. While the OT hams begrudged the loss of the band, it was not quite the dislike held for the lids who run rampant on today's CB channels.

With this introduction, you will assume I am about to engage in a furious tirade against hams or your magazine. Al contrario, I really enjoy your magazine, and still enjoy tuning the bands.

My reason for writing is two-fold. First, I want to disagree with the letter written by K. T. Derek, Pittsfield MA, which appeared in your Dec. '76 issue. If Derek is so against hams, why does he, or she, read *73* or bother writing to you? I read *73* compliments of a good friend of mine, WA1UFE, for exactly the reasons Derek pointed out. I don't find hams either "pompous" or "stuffed shirts," but they are proud. They have reason to be. If Derek or anyone else thinks they could "get a ticket tomorrow" if they wished, I think they ought to try it. I am a holder of a First Class Commercial Operator's License, not through one of these quickie memory schools that simply give the test answers, but through years of hard work, and I am proud of that! I can see that anyone who has studied ardently to get his Novice ticket would be just as proud. For this reason, hams wish to show off a little. I say that's great. You all deserve a round of applause. Anyone can say, "I could get a ticket if I wanted." But it is quite a different matter to actually do it. I would challenge Derek to try it first, before criticizing. It is like watching the tip of an iceburg protruding from the water and commenting, "There's nothing to it" or "Is that all there is?" Believe me, there is more to it than that.

More QRN came from the letter saying that the experimental phase of electronics went out with the 6L6 tube. If you think that, I am sorry for you. I have worked as an electronics design engineer for a big company. The only good designs coming from groups like that are the brainstorm black-boxes that we dream up on our own time. For the most part, the large companies are so wrapped up in sticking to standard procedures that they will not let their engineers develop new ideas on company time. All they are concerned with is cosmetic changes to existing products that have already proven their worth on the money market. Take just one example: the well-known TV games. To my knowledge, the first such unit was a basement "black-box" unit called "TV Tag," in which each player had a dot on the screen and they chased each other around the screen. This wasn't much, but it was enough to make one man go to his garage and build the famous "Pong" game. This started the Atari Company, which is now a big business. Only after the Pong game proved itself a money-maker did the big companies jump in with hundreds of varieties of the game to get a little of the cream. No, I'm afraid your idea is just QRM.

My second reason for writing at this time, and a more important one to me, is the new *Kilobaud* magazine. I don't want to miss even one issue. If the I/O sections which have been appearing in *73* are any indication, this will be the magazine we have all been waiting for. I do not know what the yearly fee will be, but we can straighten that out later. Please put me down for a year's subscription, starting with issue number one, and bill me. Tnx.

Dan Mickle
Lodi OH

MISSED POINTS?

I must compliment your policy of printing everybody's views, however far off base they may seem. At the same time, I can't resist commenting on G30GR's article in the December issue. I'm afraid, however, that it was ill-timed — it would have been more appropriate around the first of April.

Seriously, though, lest some beginner misinterpret the article, some form of analysis is necessary.

He was trying to prove or disprove the effectiveness of correct antenna matching in terms of radiated signal strength. He started with an antenna, cut to resonance, evidently, according to the basic antenna formula. However, he had no way of knowing the antenna impedance with which he was starting. This factor varies with wire size, wire type, physical orientation of the wire, its height above ground, and the conductivity of that ground. He points out that, with the wire going directly into the transmitter output, he was able to get a resonant condition. Well and good. Luckily the wire was within the range of the transmitter's output network, and so needed no tuner in the first place. Nonetheless, he noted plate current and antenna current. Fine. A given power into a given impedance produces a given current—Ohm's Law.

When he added a tuner, he had to change the settings of the transmitter's output network; consequently, the transmitter's output impedance was different. The tuner then transformed this new transmitter output impedance to the antenna impedance, which was the same as before. Same plate power, transformation through the transmitter output circuit to a lower impedance, then back up via the tuner to the same antenna load impedance as before. Pi-network and tuner resonated, little or no power loss, same antenna current, of course! All he proved was that the tuners do work. He varied the transmitter output settings and brought them back up to the antenna impedance with the tuner.

When he changed antenna length, the antenna current was different because the antenna load impedance was different. Since he was matching the new antenna impedance to his transmitter, and then putting the same power into the antenna, of course his radiated field stayed the same.

Now, when he mistuned his tuner to get a 5:1 vswr, and then put the same current into the antenna, he failed to say whether his plate current dipped to the same level or a different level — he only says that it dipped. I certainly hope he didn't operate for long under those conditions, since with a 5:1 swr, nearly forty-five percent of the power being generated was heating up the plates of his output tubes.

He noted that the antenna apparently changed the values of L and C required for resonance. Antennas do that. Depending on length, they add either L or C to the circuit.

His closing remark was quite correct. No tuner made will add S units to your signal. They only transform the antenna impedance to known values so that you can go into your equipment with coax of known value, and little things like interference filters will work. Also, when the swr is low, all the power being sent to the antenna is staying there. The tubes last longer and you don't have as much TVI, or as much rf floating around your shack. There is no myth to that. To increase radiated field, you must put more power into the antenna.

In conclusion, I want to emphasize that I'm not trying to pick the guy apart. He had the courage to experiment, which few hams do nowadays, and he had the pride to write his conclusions. My only criticism is that he seems to have missed a point or two in his evaluation of those experiments.

Bill Hood W2FEZ
Albion NY

G30GR REPLIES

W2FEZ seems to be making some points I made, but in other words. The article does *not* cover the need for a flat line for harmonic filter, etc., but the fact that end-fed antenna length is unimportant in the terms described, and losses if any in using it as a load via an ATU. Without repeating it all, perhaps I can make my point again briefly. An end-fed wire does not need to be cut to resonant length in the interests of radiation. This is easily proved as described.

On the point of a high swr in a line from the pi tank, this does not of course cause 45% loss at 5:1, or virtually any loss. Assume the wire is fed directly from the tank, and tank values allow its impedance and reactance Zj to be suited; then maximum swr equals maximum antenna power. Now suppose the tank is engineered for 50 Ohms. We use L and C to suit, and able to take the calculated voltage and current. We may not be able to use this at some high value of Zj because excursions will exceed component ratings. But we could engineer the tank for any load, with the same output power. If we had enough L and C rating and adjustment, the tank could be used with 50 Ohms, 1k, or anything, with reactance too. I have fully adjustable pi tank, coax to swr indicator, coax to antenna tuner, antenna current meter, then antenna. Radiated power is the same for 1:1 swr as for 5:1, 8:1, or any other figure. This is readily proved in the terms described, which once again are nothing to do with the need for, perhaps, under 2:1 swr to avoid damage to a tiny transceiver tank, or matters such as TVI, etc., which were not the subjects covered.

Frank Rayer G30GR
Worcestershire, England

GRATITUD

4259 Bedford Ave.
Brooklyn NY 11229

Dear Larry,

I don't know what this letter will mean to you. But this in all sides a great testimony of real Gratitud. Why . . .? Well I say that one must be grateful for those peopple whom teaches us anything, even if this is only to put the table in the correct place. I haven't find too may Intelligent peopple in this rotten world. I'm shure that you are one of them; many technician know a lot about Electronics, but they have many tricks in their brains if they have any brains. This (I call tricks, only because my English is very short . . .) avoids them to think correctly and to "give" others what they have. You call them Selfish . . .? or egoist dogs. Thanks again and read this . . .

I do not know how the counters count . . . I pretend to make one for me, but this is almost impossible at the moment. I'm a very old 53- man, and although I work almost in any branch of Electronics this Digitals are new for me. I haven't too meny books about it and if any, they cover the line in a very rough manner, so its not easy to understand them, many as you know cover "the way to make them" (?) do I want to make them . . .? Or

. . . how many technicians you know who want to make IC's . . .?

But YOU GO TO GROUND EXPLANATIONS, You make your things for very Stupids like Myself, and this is the way we need it.

This letter in the other way, is to ask you to GO ON. Even if you write only for me (I don't thik so) Just keep on. You have somebody who reads your articles with avid curiosity. I wait the mail every month, to keep my subscription to the best Amateur Mag. and see what new things I learn about digital affairs.

Keep ON again, just tell us HOW THE THINGS ARE MADE. Because I know how divider, or better What dividers make, But how . . .? What means Enable . . .? And so on . . .

I'm in Electronics since 1935. A real proffesional since 1938; I can make almost anything in the row, this is really something NEW for me, and I do not learn very fast by now, and I have many things I want to learn, in one word Larry, Medical Inst. and Industrial Controls are by now absolutelly Digital. Signal tracing is my system, but first I must learn what they are to see any signals. The world will be Digital . . .! Or is it allready . . .?

Again . . . How an divider, divides . . .? How an Flip Flop makes the thing . . .? You told me about. Now just give us more, you can make a complete description of a counter and how can I use it and most, how can I make one . . .? The list may be very long and very tedious to you, practically anything you can make will be quit welcome by many in any part of the world *73 Magazine* goes.

Good fellows like you, make *73* very atractive, very very atractive. We learn . . . and that's why and enough. Rather than having any Magazine with a lot of "Boxes", and also many explanations, I never read. I'll get *73* for as long as I can get anything from reading it. You are the first I read, Really HONESTLY SAID. All other magazines for Amateurs are very dificult to follow, for they make articles Absolutelly Imposible to copy, if they are not very expensive, they are too complicated and not always are with easy instructions to follow. Besides if they are not interested in Mexico, just why they send the magazine to us . . .?

Amateurs are beautiful, They make a lot of things "Without any Engineering". My contact with them is for I make repairs in any SW receiver or Transmiter. I'm not active because the rules in Mexico are very misadjusted. They want me to learn 5 words per min. in Morse Code . . . And I'm very old for learning anything I consider OUTSIDE OF ELECTRONICS. I argue to them that is more necessary to make to learn any guy whom makes an aplication for amateur, and more important to know, what they can make with 1000 Volts, and what they should NOT to do, and that this H.V., simply Kills. Those I remember long time ago, are Dead . . . because High Voltage Kills for ever, and nobody told them So.

Well dear Larry, (May I call you, Just Larry . . .? You call me Bill. This is the translation to English of my name which is Guillermo), I have friends all over our continent. Your contact with *73 Mag.* makes one of my best.

At least one man in Mexico, as I know is waiting for your writings and remainds you not to forget the next article to *73 Magazine*. I'll be waiting . . . Good By Larry, and remember again . . . We need your articles . . . Keep going ahead, give us more to read about Digitals. Many guys like me, need them. And I think this is all over the American Continent.

Guillermo Moreno Rivas
Sindicalismo # 87-219
Escandon Z 18
Mexico

You know . . . it's letters such as this that make it all worthwhile. I have gotten many letters which thanked me for the articles, but this missive is most sincere.

It speaks not only for my efforts, but for yours as well. You print them.

Larry Kahaner AB2NEL
Brooklyn NY

LESSONS FOR ADSIT

I've just finished reading Norbert Adsit's article, "Design Your Own PC Boards — the styrofoam solution," in the Holiday edition of *73*. I'm still smiling. Some time ago, I made my first PC board. A lot of time and effort went into its design and fabrication. That board ended up in the garbage can because I hadn't kept in mind that if you design the board from the component side, you must reverse everything from right-to-left when you transfer the design to the foil side.

It was a hard but enduring lesson and one that Norbert Adsit needs to learn.

For anyone who jumped in and made a board following the system proposed in the article, I believe they may be able to salvage their boards if they will mount the components on the foil side. Their soldering techniques will suffer since the components will block free access to the leads. The end result will look a bit primitive but should be serviceable.

For those who are adventurous, I suggest that they go ahead and mount their parts on the component side of the board. They will need to be extremely careful about making sure they are using the right holes since they won't be where they laid them out. I believe components with two leads can be handled easily enough if special attention is paid to polarity sensitive components such as diodes. Those parts with more than two leads, like transistors and integrated circuits, would require fairly drastic measures. In essence, these components would need to be placed upside down on the board and their leads bent back down into the board. This would be risky since it would be easy to break some of the leads or to get confused as to which lead was which.

I would use these methods only as a last resort. But for those who invested their time and energy making boards with Norbert Asdit's system, these ideas may have some value.

D. E. Stanfield
Atlanta GA

NORTH OF SIXTY

Just a little note from "North of Sixty" to commend *73 Magazine* and some of its advertisers. In addition to S.D. Sales, Godbout, and James Electronics, please include Bullet Electronics and Quest Electronics, who also give very good and speedy service. Bullet's kits have well-made, very small PCBs and, although some of the parts are not always easy to identify, the kits go together well and I have had no problem in getting them to work.

Nice to see that you have gone to the tear-out Reader Service card; sure is much better than having to cut a chunk out of the pages which made a mess when one collects the magazine and likes to keep it in as good condition as the Postal Service delivers it in (Ugh).

It's also very pleasing now to find that certain of the articles now have a source or printed circuit boards available; this is really a boon to would-be constructors who do not wish to fabricate their own.

Really like your magazine here — good easy to read articles, mostly easy to make projects, and a bit of humor thrown in.

73 and keep up the good work.

F. V. (Vic) Greenleaves VE8AM
Whitehorse, Yukon

OLD HAT?

I'm sure an all ham radio wedding is old hat by now. But, I thought you might enjoy this picture. For us, it's the best in the album. As yet no one will confess to the artwork, as the "HT" wasn't there when we arrived at the church!

Dana Henry WB8GUU
Elyria OH

TECH REAX

I have been subscribing to your fine magazine for about three years now. Your articles and editorials are always interesting, and it is good to have someone such as yourself who can articulate what I'm sure many of us think and feel.

I would like to respond to your editorial in the December issue concerning support for Tech class operators on 10m. You posed several questions that I feel can be answered. The absence of activity on 220 is because there is basically no advantage or difference over two meters. If one already has 2m equipment, there is no practical reason to want to get on 220 since the range and type of operation is primarily identical. I think this also goes for the other VHF frequencies. Incidentally, I'm talking about the average everyday Tech class operator, and not about the more admirable (but rare) type who has the ambition and facilities to experiment with new and higher frequencies just for the sake of experimentation. Since 2m is the first band most Technicians get on, they stay there because there is no incentive to go elsewhere.

However, six meters is an entirely different case. From firsthand experience, I firmly believe the main reason the band is empty is the difficulty with television interference. 6m sideband would be great, except that most people live in subdivisions and not in the middle of a twenty or thirty acre farm. When half the people within a mile or two of you are running rabbit ears and trying to watch football on channel 2, any talk of high pass filters, low pass filters, and quarter wave twinlead stubs, etc., becomes purely academic. With the TV's AGC running wide open to bring up a weak TV signal, the only place for a filter would be the antenna lead's connection to the chassis inside the set. I don't have to spell out the time, expense, liabilities incurred, etc., involved in clearing up TVI for 50 or maybe even 100 cases such as this. Other options available might include letters and/or visits from the FCC, as well as explaining to the lynching

party on your front lawn exactly why it is necessary for you to regularly interfere with their favorite pastime. Thus, the only band available to Techs which even marginally offers any promise of DX, WAS, and all the other goodies associated with low band operation, comes out looking pretty dim when compared with its disadvantages. Therefore, when given an even halfway attractive alternative, most Technicians will take it, and there you are again up on 2 chewing the rag unobtrusively with some other Tech who lives across town instead of across the country.

Now comes the question of why the 200,000 General and above licensees don't flood onto ten with rag chews and DX pileups. It is a matter of relative value. They already have 75, 40, 20, and 15, with good antenna setups, nets, scheds, and a lot of friends on their favorite frequencies. They simply don't need 10m for their enjoyment of ham radio. In much the same way that Techs have no reason to move to 220, a General class licensee feels no compulsion to rush up to 10. The situation could be compared to offering a 79 cent bottle of Ripple wine to someone sipping on a case of champagne. He probably won't knock you down to get it. However, offer the same bottle to a wino with the Monday morning shakes and see what happens!! Similarly, Generals or above perceive 10m to be inferior to the other HF bands available to them because of erratic propagation or some other reason. This is not a value judgment of my own, but is based on the amount of activity found there. On the other hand, 10m would be extremely attractive to a Tech class operator because it would be the only HF band available to him. Also it would be far enough from television frequencies so that those problems could be handled in the conventional manner if they arose at all.

Finally, one could argue that SSB privileges for Techs on 10m might encourage some percentage of them to upgrade. CW is not every man's game and many people probably won't spring for the five or six hundred dollar tab associated with most 5 band transceivers just for Novice privileges. Many of those same people might, however, if they knew they could operate phone on at least one band while improving their code speed on the others. This would provide a strong incentive to upgrade since they would already have paid for the equipment, and all that stands between them and its full utilization would be the increased code proficiency. In addition, a few hundred purchases of rigs based on this premise certainly couldn't do our economy any harm, could it?

I have tried to confine myself to the topic of behavior and facts related to life in the real world. Discussions of whether a person should be "given" something when others have "earned" it, etc., are an entirely different subject. Similarly, questions such as, "If you want it, why don't you just get up to 13 wpm . . ." are not related to this discussion. Most people behave in a rational manner; that is, they expend effort only if they perceive the benefits to be worth the time and work required to achieve the goal. Evidently, there are a great many Tech class hams who don't perceive the increased privileges as being worth the effort involved. As ignoble as this may seem, it is still a fact borne out by the number of long time Technicians who have held their licenses for ten or fifteen years.

However, based on my own experience and conversations with others, there is still a strong desire to engage in HF type operation by most Technicians, and ten meters would attract many of them if the regulations allowed it. After all, that is the important thing — to get a significant number of ham operators on ten meters.

Thank you for giving me a chance to express my opinion.

Keep up the good work.

L.N. Thompson WB4WNV
Austell GA

EXTENDED BASIC

A helpful note regarding Joe Kasser's fine program in the Nov. *73* is that if anyone runs this program in Altair Extended BASIC, the variable "MODE" in lines 600 and 615 will conflict with a reserved variable MOD. Just change MODE to another variable such as M5 and the program will also run in Extended BASIC.

Keep up the good work.

John DuBois W1HDX
Boxborough MA

KANGAROO COUNTRY

I enclose $20 in US funds for a 3 year extension. I like the present format; it's very good. Thought the "Eyes for Your Shack" in Nov.-Dec. '75, one of the best articles that I have ever seen published. I like articles on advanced test gear very much; more please from the same author. Have had very good results from Bill Godbout, Poly Paks, James, and Gateway, on mail orders.

Greetings to all the *73* staff from "Kangaroo Country."

Wally Payne VK3YP
Victoria, Australia

A SIMPLER SOLUTION

All good credit to K5AR/7 regarding the "Turn Signal Reminder" on p. 166 of the Holiday issue of *73*.

Several years ago I found a simpler solution: I connect the Sonalert directly across the terminals of the turn signal flasher. Polarity must be observed, of course.

I found it necessary to muffle the unit by wrapping it with tape. My co-pilot objected furiously!

Chester L. Doll KØPTG
Omaha NE

FT-101 uP??

I don't know much about micro hard and software, and it'll be a while before I can afford a system, but you can bet your floppy disk I will be keeping *73* I/O and the new *Kilobaud* mags on my reference shelf for a long time!

Think of the future uses of computerized ham radio! How long will it be before microprocessor based transceivers are put on the market? Auto ID . . . processor-based CW/Baudot/ASCII system . . . "punch-up" frequency selection . . . a new mode?? Who knows, a Yaesu FT-101 uP???

Keep fightin', Wayne; we'll get our way yet.

Mark Herro WB9LSS
Oconomowoc WI

LIFE

I am pleased to become finally, after at least ten years, a lifetime subscriber to *73 Magazine*. You have pushed and prodded me on many occasions into trying new and exciting innovations appearing in the field of electronics. It was because of your insistence that I finally started into two meters, and I have been glad, of course, ever since. With the advent of *Byte Magazine*, I renewed an interest in computers and shortly thereafter purchased one which I have been using ever since. It is proving to be a source of continued inspiration and intellectual challenge both to me and my 13 year old son who is now the acknowledged computer program debugger of his school.

So I owe indeed a great debt of gratitude and thanks to you for all your encouragement, albeit indirectly.

With best wishes for a happy, healthy and prosperous New Year.

Gerald E. Meltzer M.D. WØFFC
Aurora CO

MICKEY AND FOXY

Thought I'd give you a bit of background. I, Mickey, am a hardware person, and my wife, Foxy, is a software person. Until the advent of microprocessors, I had always considered software to be "woman's work" (being a good MCP, as the women's libbers might say). I have an Advanced class amateur license and a First Class Commercial Radiotelephone License with Radar Endorsement and am employed in electronics by Ma Bell (sorry 'bout that!). After the Atlanta Hamfest this year, I came home and told Foxy that I wanted a computer. Contrary to what you might expect, her reaction was somewhat akin to my having said, "Robert Redford is going to spend a few days with us!" You see, my wife has had about 6-7 years of programming the big monsters (ISM, Univac, etc.) in COBOL and Assembly languages.

We discussed (argued) extensively as to what constituted a "minimum acceptable system," finally deciding that it was: 1. No bootstrapping allowed; 2. Minimum of 16K RAM; 3. Minimum two tape machines; 4. Hard copy printer; 5. CRT control terminal. Then we decided on a maximum of $1500 total system cost. The problem of which computer system was therefore very easily resolved; only from SWTPC could we purchase our "minimum acceptable system" for our "maximum total system cost" or less. On July 22, 1976, we took delivery of an M6800 computer, AC30 cassette interface, CT1024 terminal, and PR-40 printer from Atlanta Computer Mart.

Once the assembly of all the kits was completed, I felt that the fun was over, so Foxy gave me an operating system as a project. She helped in the "blueskying," and gave some help and encouragement when I got stuck (also helped in putting an article together), but mostly let me work it out for myself. So I must share the credit for the OS.

Mickey (and Foxy) Ferguson
Trenton GA 30752

Mickey and Foxy have put together a rather impressive Operating System for their 6800 and their article on it will be in an upcoming I/O section. A tape of the program will be offered through the 73/Kilobaud *Software Library, also. — John Craig.*

HOOKED

This letter is going to be a combination of things, as I've put off writing this for a long time, and the things I want to say piled up.

First, I want to add my praise for James Electronics to that of John Dieringer W6RVP. Their service is not only outstanding, it's phenomenal. I've ordered from them three times now, and in each case have received my parts back in *five* days. They must have employees waiting in line to fill orders. Keep it up, guys.

Second, tell Mary in Reader's Service not to despair; I finally noticed the little card in the back of your mag and decided to send it in.

Third, keep the digital (and *anything* on microprocessors) stuff rolling in. When I first subscribed to *73* this summer, I read the first issue and about cancelled my subscription. Where were all those pages upon pages of thrilling contest results? Instead, you had printed articles about incomprehensible boxes called microprocessors. Well, you've got me hooked now, and although I haven't got a computer, I'm about ready to subscribe to *Kilobaud*, out of sheer curiosity, if not interest. Those computers are getting more and more comprehensible with every issue. But I'd still love a book on the basics: programming (BASIC), memories, interfacing, peripherals, the codes used (what the heck are Baudot and ASCII?), or in short, anything for a newcomer. A tall order, Wayne, but

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BE MY GUEST

visiting views from around the globe

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MHz) is dead for the moment because of the 40 channel expansion and strong objections from other services. However, the Communicator Class proposal (Docket 20282 . . . 220 and above without code) is still being actively considered. FCC officials admit that both proposals are in limbo, while the CB problem takes their attention. They also emphasize that the impact on ham radio will be as minimal as possible. Nevertheless, it's clear that amateurs can no longer stand on the sidelines and watch the wrestling match between the FCC and CBers. There is more at stake now than Novices or Technicians with 10-4 accents. Our frequencies, amplifiers, and status with the FCC may be in jeopardy.

So what can we do about it? For one thing, amateurs everywhere should promise themselves that they will reply when the FCC asks for comments on the amplifier docket. There *are* some alternatives. How many ham rigs are capable of 10 meter operation? In the Holiday issue of *73*, 25 rigs are advertised with 10 meter capability. Only two of them operate with less than 200 Watts input. Consider the fact that the linears FCC is worried about average 2 to 4 Watts input, 100 to 250 Watts output. How about a rule requiring all linear amplifiers to have a minimum drive power of 100 or 150 Watts? Another alternative would be frequency coverage. How about limiting amplifiers to frequencies below 21.350 MHz? Remember, no matter what the FCC finally decides to do, home brewing will not be outlawed and existing equipment won't be affected. So the effects on ham radio *can* be minimized, if we all get off our tails and react constructively when the FCC requests comment. As one FCC official told *73*, "There are millions of CBers operating with illegal power or out of band . . . compared to the thousands of hams capable of using 10 meters with amplifiers, ham activity on 10 meters is a drop in the bucket . . ." Why not help flood the FCC's bucket . . . and turn the amplifier ban against the illegal CBers? Think about it. (Recent change in FCC procedures only requires an original and 5 copies instead of 13.)

Warren Elly WA1GUD
Associate Editor

Handicapping the Handicapped

With the large number of people becoming interested in amateur radio, an increasing concern for the FCC is arranging exams for handicapped persons who are able to travel to examination points but unable to take the test in the conventional way. Although the FCC did do away with Conditional class exams last year, those unable to travel can take the exams at home for Technician, General, Advanced, or Amateur Extra when a physician's certificate shows them incapable of the trip. Another change in the rules: Instead of the applicant picking his own volunteer examiner, that choice is now made by the FCC.

With blind or deaf prospective hams, the situation is a little different. An FCC spokesman told *73* that a formal testing structure has been in existence for the blind for a number of years. The code exam is the same, but the written test is done in one of two ways . . . Braille tests are available or the exams are read to the applicant by the FCC examiner. In both cases, schematic diagrams are eliminated.

The plight of the deaf applicant is the most difficult of all. In their case, the FCC makes no provision for a CW test. The FCC told *73* that according to the way international regulations are worded, the applicant is required to *hear* CW in order to obtain a license. This creates a sticky problem for the FCC, who must give the applicant a waiver from hearing the code, while still requiring them to pass the code exam. FCC field offices have no equipment for non-aural copy of code, so the applicant is forced to furnish his own means of transferring the FCC exam tape into a medium he can copy. The most common method used, according to the FCC, is some sort of homebuilt device that changes the sound into vibrations using a buzzer or speaker arrangement. Lights can be used; however, the slow damping factor of regular lightbulbs makes them impractical for speeds of over 5 words per minute. LEDs, because of their almost instant damping, should be usable to higher speeds, although no data on their use in this type of application is available.

The FCC told *73* they have no present plans to make provisions for deaf applicants because, as yet, their numbers are extremely small. No estimate was available on the number of handicapped amateurs in the country, and a check with the FCC field office in Boston disclosed that the examiner there had never given an exam to a deaf person.

Although deaf people represent a very small percentage of the population, and those who wish to become hams are an even smaller number, it seems the FCC should make some provision to help these people deal with the examination process. Non-discriminations laws are in existence to help those who would otherwise be discriminated against because of their handicaps, and if the FCC is unable to do this, perhaps one of our readers could help with plans for an inexpensive sound-light or sound-vibration unit.

Those wishing further information about waivers required should write to The Chief of Rules and Regulations, Amateur and Citizens Division, Federal Communications Commission, Washington DC 20554.

Stan Miastkowski WA1UMV
Associate Editor

Inside the "Big Noise"

What is the "Big Noise" and what is its purpose? Those questions have been generating a tremendous amount of speculation since the appearance of the noise last summer with its subsequent disruption of radio communication throughout the world.

The sporadic interference has been heard throughout the HF spectrum from 2 to 24 MHz. Signals last anywhere from thirty seconds to half an hour, are pulsed at 10 Hz, and have been measured with bandwidths of up to 300 KHz.

Theories abound on the noise, the most common holding that it's some sort of propagation study. High-placed sources decline comment on the purpose.

Other theories range from HF radar to a new navigation system. The latter was backed by an FCC spokesman who said that although direction finding is very difficult, because of the large distance involved, the FCC believed the noise is coming from at least two transmitters located in the Minsk area of the Soviet Union, about five hundred miles west of Moscow.

A logical theory was put forward by George Jacobs of the Board for International Broadcasting in Washington. He theorized the Soviets might be testing parts for a new high powered transmitter and added that if the U.S. were building such a unit, we would be doing the same type of testing.

The noise disappeared for nine days during the middle of November and was believed to be gone for good when it abruptly appeared again. According to FCC Chief of International Operations Robert Cutts, the Commission sent 5 informal complaints through the Soviet embassy since the noise began. He added that a reply was not expected since the Soviets seldom even acknowledge receipt.

With the noise continuing as strongly as ever, the FCC asked the State Department to issue a formal complaint, the next step on the ladder of protocol. As that complaint was being prepared, an unexpected event took place – the Soviets replied to the FCC's complaint. The tersely worded statement from the Soviet Union called the noise an "experimenal use of the radio spectrum which will be terminating shortly." There was no further indication as to when the noise would be cut off or of its purpose. The Soviet embassy in Washington said that they were "aware of the situation" and declined further comment.

The Soviets' admission caught government officials completely by surprise and left them mystified. An FCC source theorized that the Soviet statement was the result of heavy political pressure coming from all over the world. Being extremely close to

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Special Report

by Warren Elly WA1GUD

It is most important that the material in this 73 Special Report be kept in the right context. The FCC draft must now withstand public comment (the deadline is January 31, 1977) before becoming final. It will then move on to other WARC sessions on an international basis, prior to the 1979 conference. The US, like all 100 countries envolved, has only one vote . . . and therefore the FCC's proposals carry a lot less weight than they may seem to on the surface. The frequency table does, however, offer an updated perspective on the FCC's feelings about amateur radio and CB, especially when one considers the 220 MHz allocations, and references to mobile services throughout the table.

THE BUZZWORDS

ITU – The International Telecommunication Union, whose regulations govern communications on a worldwide basis. 150 countries have agreed to be bound by ITU and its all-important table of frequency allocations. The ITU is directed by an Administrative Conference held each year, which can call for regional or general membership meetings on an "as needed" basis. It takes a vote of the ITU members to call such sessions. Every 7 years ITU holds a Plenipotentiary Conference of the membership, which in turn can call a world conference (WARC).

WARC – The World Administrative Radio Conference, held as necessary at the call of ITU members. WARC is the big one, where international allocations are decided.

IARU – The International Amateur Radio Union, ham radio's international lobby, with 90 societies representing nearly all licensed amateurs in the world. The IARU doesn't just lobby with ITU and during WARC; it also serves as ham radio's contact with the governments of each country, usually through their communications ministry or FCC equivalent.

Region 1 – The area including eastern and western Europe, Africa, the Middle East including the entire Saudi Arabian peninsula, all of the Soviet Union and Mongolia.

Region 2 – The Western Hemisphere including Greenland, but excluding Iceland.

Region 3 – What's left: the South Pacific, Southeast Asia, and Oceania.

The Breakdown

BAND	EXISTING (Region 2)	FCC (Region 2)	STAFF RECOMMENDATION (ARRL)[1]
1875m	no allocation	160-190 kHz exclusive *amateur*	160-190 kHz
160m	1.8-2.0 MHz subject to regional restrictions	1.750-1.9 MHz[2] *amateur* shared with fixed, mobile, aeronautical radiolocation and navigation	1.715-2.000 MHz
80m	3.5-4.0 MHz shared with fixed, mobile, broadcasting	3.5-4.0 MHz *amateur* exclusive through 3.9 MHz[3]	3.5-4.0 MHz
40m	7.0-7.3 MHz shared with broadcasting	6.95-7.3 MHz *amateur* exclusive,[4] *amateur satellite*	7.0-7.5 MHz
20m	14.0-14.350 MHz	13.950-14.400 MHz *amateur exclusive amateur satellite*[5]	14.0-14.5 MHz
15m	21.0-21.450 MHz shared with maritime mobile, fixed	20.7-21.2 MHz *amateur, amateur satellite* exclusive	21.0-21.5 MHz
10m	28.0-29.7 MHz exclusive	28.0-29.7 MHz *amateur* exclusive, *amateur satellite*	28.0-29.7 MHz
6m	50-54 MHz exclusive	50-54 MHz *amateur* exclusive[6]	50-54 MHz
2m	144-148 MHz exclusive	144-148 MHz[7] *amateur* exclusive, *amateur satellite*	144-148 MHz
1¼m	220-225 MHz shared with fixed, mobile, radiolocation, aeronautical, broadcasting	220-225 MHz *amateur, amateur satellite*, radiolocation, mobile[8]	220-225 MHz
¾m	420-450 MHz shared with radiolocation	420-450 MHz[9] *amateur, amateur satellite*, shared with radiolocation	420-450 MHz
3/8m	no allocation	902-928 MHz fixed, radiolocation, primary; *amateur*, mobile, secondary	902-928 MHz
1215 MHz	1215-1300 MHz	1215-1300 MHz radiolocation, primary; *amateur, amateur satellite*, secondary	1215-1300 MHz
2300 MHz	2300-2450 MHz	2300-2450 MHz radiolocation, primary; *amateur*, secondary	2300-2450 MHz
3300 MHz	3300-3500 MHz	3300-3500 MHz radiolocation, fixed, fixed satellite, primary; *amateur, amateur satellite*, secondary	3300-3500 MHz
5650 MHz	5650-5925 MHz	5650-5925 MHz radiolocation, primary; *amateur, amateur satellite, secondary*	5650-5925 MHz
10.0 GHz	10.0-10.5 GHz	10.0-10.5 GHz radiolocation, primary; *amateur*, secondary	10.0-10.5 GHz
24 GHz	24.0-24.250 GHz	24.0-24.25 GHz[10] *amateur, amateur satellite*	24.0-24.250 GHz
48 GHz	48.0-50.0 GHz	no amateur allocation[11]	48-50 GHz
71 GHz	71-84 GHz	71-76 GHz radiolocation, primary; *amateur, amateur satellite*, secondary	71-76 GHz
152 GHz	152-170 GHz	165-170 GHz radiolocation, primary; *amateur, amateur satellite*, secondary	165-170 GHz
200 GHz	200-220 GHz	no amateur allocation	no proposal
240 GHz	240-250 GHz	240-250 GHz radiolocation, fixed, mobile, primary; *amateur, amateur satellite*, secondary	240-250 GHz
300 GHz and above	300 GHz and above	no international allocation proposed[12]	300 GHz and above

[1] *The ARRL had proposed additional bands at 10, 18, and 24 MHz, all of which were left out of the FCC final draft (see text).*

[2] *In regions 1 and 3, the FCC proposes 1.725-1.750 MHz, which would in essence be another "DX window." "It cannot be readily determined whether or not worldwide allocation of these bands to the amateur service is practicable due to the lack of knowledge regarding spectrum requirements in other regions." – FCC WARC draft.*

[3] *In regions 1 and 3, 3.9-4.0 MHz is shared with broadcast, fixed, and mobile.*

[4] *In regions 1 and 3, 7.1-7.3 MHz is shared with broadcast.*

[5] *The FCC draft calls for amateur satellite allocations only between 14.0-14.250 MHz.*

[6] *In region 1, broadcasting is allocated between 47-68 MHz.*

[7] *In region 1, fixed and mobile is allocated between 146-149.9 MHz. See text for aeronautical pressure on 146-148 MHz.*

[8] *Class E CB is left in the FCC document under the mobile classification "To provide for extensive development of amateur satellite techniques; to provide for the expanded land mobile need." – FCC WARC draft (see text).*

[9] *There is no amateur allocation proposed for region 1 between 440-450 MHz.*

[10] *Amateur and amateur satellite are primary between 24.0-24.05 GHz; only amateur is allocated between 24.05-24.25 GHz as secondary to radiolocation.*

[11] *The FCC draft calls for reserving 48-50 GHz for aeronautical and maritime services.*

[12] *Although the FCC is proposing no international allocation for 300 GHz and above, WARC is not expected to affect amateur and experimental use domestically.*

The Analysis

1875 METERS

With the announcement of the FCC's proposal to introduce to the WARC a recommendation that hams be allowed to use the frequency band between 160 and 190 kHz, the possibility now exists that within a few short years amateurs may be able to explore a whole new area (to us, anyway) of the radio frequency spectrum. Although similar in nature to medium frequencies, the low frequency band is much more sensitive to atmospheric and electrical noise. Propagation is primarily by ground wave; however, skywave is possible.

Traditionally, LF equipment has employed large rf coils and tuning capacitors for high-Q selectivity. With the advent of integrated circuit operational amplifiers, however, miniature high-Q stages are now practical. Direct conversion "synchrodyne" receivers are also effective in this portion of the spectrum.

Conventional antenna practices have historically been used at low frequencies; most early long wave radio stations used high and large wire antenna systems. Because of the long wavelengths involved, indoor loop antennas are often satisfactory as receiving antennas, as they encounter a minimum of phasing and reflectivity problems. Often, a vertical ground or roof mounted whip is highly satisfactory. A good ground at these frequencies is mandatory.

The most that can be said of the proposed new 1875 meter band is that it will be similar to 160 meters, only more so, and if you like 160, you'll love 1875. I wonder who will be the first to work 100 countries on the new "Top Band" (if we get it)? *Includes excerpts from 73's forthcoming publication, "Communication Monitoring" by Robert B. Grove.*

160 METERS

With increased interest in the 160 meter band, due to the current decline in the sunspot level, many eyes will be turned to the WARC to see what will be the result of its action concerning the band many in the hobby affectionately refer to as "Top Band." The FCC proposal to the WARC contains what may at first glance look like a net loss of 50 kHz. However, after analysis, this may not be the case. The "new" proposed 160 meter band would run from 1750 kHz to 1900 kHz, with the bottom 50 kHz being coequal primary with direction finding. The top 100 kHz would be exclusive amateur and not shared with Loran as is currently the case. At present, 44 percent of the amateurs within the US in the states of AK, AZ, CA, CN, ME, MA, NV, NH, NJ, NY, PA, RI, VT, WA, and OR are not allowed to operate above 1900 kHz, and a majority of these hams are only allowed to operate in a 50-75 kHz section of the band below 1900 kHz. Therefore, by opening the entire 150 kHz 160 meter band to amateurs throughout the entire US, this would in effect be a gain to most "Top Band" users.

80 METERS

The FCC plan leaves 3.5-4.0 MHz the same as it is now. Between 3.5 and 3.9 MHz, amateur allocations will be worldwide exclusive, with only two exceptions. Above 3.9 MHz the FCC proposal allows for the same sharing with SW broadcast as now exists . . . as an FCC spokesman put it, "The existing character of 75 meters will remain . . ." The top segment of 80 meters remains threatened, however, with the SW broadcast interests pushing for the upper band.

40 METERS

If you're a 40 meter man, you'll love the FCC proposal. The lower end of 40 would go down 50 kHz to 6950, with the first amateur satellite frequencies starting there (for downlink purposes). From the new band edge through 7100 kHz allocations would be exclusive amateur, but SW broadcast would continue to enjoy its stranglehold over 7100-7300 kHz. There are some indications that the Soviets, at least, are becoming less interested in SW broadcast, and it's hoped by the time the WARC allocations get into practice the broadcast QRM may be abated. Another unanswered question is what the FCC will do about domestic sub-bands within the allocation. The debate of CW vs SSB is far from over, and 40 meters will be a battleground comparable only with 20m.

20 METERS

If you were to rank the HF ham bands in order of international importance, 20 meters would probably come out on top. And if the FCC proposal becomes a model for WARC, there may finally be some relief from the Sunday afternoon madness on 14 MHz. The FCC plan calls for 100 kHz worth of expansion, stretching 20m from 13.950-14.400 MHz. The entire band would be exclusive amateur, allocation-wise, with 14.0-14.250 a satellite band in the FCC plan. Again comes the question of how the FCC might divide the new segments. But first we have to get them at WARC, so it's tough to get a reading from Washington. Sources say, however, if amateur radio is to get anything out of the conference, the 20 meter expansion will probably be it.

15 METERS

A lot of the initial reaction to the FCC WARC plan has focused on 15 meters, largely because it is the most radical change for HF. The band would be moved down 300 kHz, to 20.700 MHz, while the top end would come down from 21.3 to 21.2 MHz. A gain of 150 kHz, with satellite authorization to boot . . . but a lot of fellows reacted negatively, arguing that their equipment couldn't make the hike. (Actually a pretty weak argument, if you think about it.) On the plus side, the new 15 meter arrangement would put us that much further away from fixed allocations at the top end of the present band.

10 METERS

There is no change in the FCC plan for 10 meters over current allocations. The band would remain 28.0-29.7 MHz on an exclusive basis, with amateur satellite sub-bands. Nearby, on 27 MHz, the FCC plan calls for the so-called ISM (Industrial-Scientific-Medical) and Fixed-*Mobile*. The key word there, of course, is mobile, which means CB for all practical purposes.

6 AND 2 METERS

The FCC proposal leaves both 6 and 2 meters as is, with exclusivity and the same frequency allocations. The major issue here is on 2 meters, where the international aeronautical community is fighting for 146-148 MHz. Within the FCC, our sources say, that battle was waged with little success. But many at the FCC (and especially in the enforcement division) are concerned about 2 meter repeaters. They, off the record, compare it to CB, and identify the band as a potential problem. Considering the worldwide use of 144-146 MHz for repeaters ahead of the top segment as we have in the US, 2 meters may be a real WARC trouble spot.

1¼ METERS

If the aeronautical pressure on 2 meters isn't enough, 1¼ meters may give you something to think about. Added to the present allocations in the FCC plan is amateur satellite and *mobile* (CB). Taking the specifics, between 220 and 225 MHz, amateur and radio location allocations are retained, but added are satellite and mobile as *primary* services. The FCC is obviously thinking of the Class E CB proposal in making the allocation, but on the other hand, there isn't much enthusiasm in Washington for having hams and CBers share 220. There was a clear implication in off the record conversations with FCC officials that the mobile allocation was intended as a compromise, and not any sign that Class E is about to become reality. The best answer, more than one FCC source told *73*, is to use 220 . . . use it or lose it anyone?

¾ METERS

The ¾ meter band shows little change in the FCC document. 420-435 MHz lists radio location as the primary allocation, with amateur secondary. Between 435 and 438 MHz amateur would be the same, listed as secondary, with 438-450 MHz also unchanged. There are some major changes in Region 1 where 430-435 MHz would put radio location and amateur allocations on an equal basis. Also in Region 1, amateur satellite would be added between 435-438 MHz as a secondary allocation.

3/8 METERS

Another new band in the FCC WARC table is 902-928 MHz. Known as the 3/8 meter band, 900 MHz is set aside primarily for fixed and radio location services, with amateur and mobile newly added as secondary services. Some reports had also listed 935-938 MHz as amateur exclusive, but they were inaccurate.

1215-5925 MHZ

In the bands 1215 and above, the big story is satellite frequencies, lots of 'em. In fact, 85 MHz worth of new allocations are set aside in this range for satellites. Otherwise it's a matter of maintaining the status quo for the most part, with a few exceptions; like increased non-amateur use of 1240-1290 MHz, and the sharing of 3300-3410 MHz with fixed services on a secondary basis. The largest single satellite allocation in this range comes at 5650-5670 MHz, and it's listed on a worldwide basis.

10 GHZ AND ABOVE

Of two new bands proposed in committee above 10 GHz, only one survived the FCC debate — 240-250 GHz. (Another band at 300 GHz had been proposed.) To call 240 a new band requires some background, background that will be helpful in understanding the maze of information FCC staffers, and the commissioners themselves, had to sift through before reaching agreement. The band has been listed by the FCC before as an amateur allocation, but has not appeared on the international tables. Therefore, the FCC recommendations are aimed at international recognition . . . not domestic use alone. The Commission document lists amateur and amateur satellites as secondary allocations, to be shared with radio location, fixed, and mobile as primary users. But at 248 GHz the FCC has included a ±500 MHz wide ISM segment (Industrial-Scientific-Medical) which amateur users will have to work around. A similar situation exists at 165 GHz, where domestically there is some loss of allocation (at least on paper), but internationally it's a gain. But again, to say the 165 GHz band is losing frequency depends on how you look at it, since the range has been included in the FCC allocations table for some time, but left out of the rules (Part 97). As one Commission official put it, "Present action would afford amateurs secondary status in the band 165-170 GHz, but would no longer provide for 152-165 GHz which is presently available in the US . . . however, 152-165 GHz has never been implemented, so it is in essence a domestic loss only on paper . . ."

300 GHZ AND ABOVE

This range is currently unallocated on an international basis, but the FCC would like to see the WARC set it aside for amateur and experimental use, as it has been listed here in the US. Should 300 GHz and above remain off the international frequency tables, FCC planners say it would not disallow domestic use.

Continued

No one event in the next decade is likely to affect the future of amateur radio more than the World Administrative Radio Conference scheduled for Geneva in September, 1979. Delegates from over a hundred nations will gather for 10 weeks to carve up the frequency spectrum and, in the view of government experts, diplomats, and much of amateur radio's own leadership, our hobby may lose a lot more than it gains. On balance, ham radio occupies only a small niche in the global scheme of frequency allocations, and our strongest supporters (the US, Canada, Great Britain, and West Germany) are outnumbered and outgunned by the Third World.

"On balance, ham radio occupies only a small niche in the global scheme of frequency allocations, and our strongest supporters are outnumbered and outgunned by the Third World."

The Third World

If you've read very much about the current situation in the United Nations, you know that the Asian and African nations that make up the Third World now hold the balance of power in the General Assembly. (US Senator Patrick Moynihan could correct your perspective should you doubt that assessment.) In the ITU, the situation has been that way for over a decade! Because each nation at WARC only has one vote, regardless of its amateur population or actual use of the spectrum, the cards stack up much the same way as they do in the UN General Assembly ... the more affluent industrial nations are at the mercy of the newer countries that hold much of the world's untapped natural resources.

The underdeveloped nations are not tuned into ham radio any more than they are interested in satellite ground stations or CB. Amateur licensing, for many of them, was a function of colonial government ... now replaced by independence. Most of them would sooner build up point to point HF stations for communications than invest in satellites. At the heart of the problem is a lack of the technical expertise needed to utilize newer forms of communications, communications often pioneered by amateurs. But with amateur populations diminished, or hampered by an unsympathetic government, there is no training ground in the Third World for higher technologies ... and thus there is little support for amateur radio.

Ham Ambassadors?

One answer to the problem is amateur ambassadors, people who can demonstrate ham radio's usefulness and persuade the developing countries that hams can help their nation grow. It is a fact that economic and technological abilities of nations can be measured in terms of their amateur populations ... the more hams, the more advanced the country. The ham ambassador idea probably might have worked better some years ago considering what's happened to American prestige abroad. Government sources in Washington react to the ham ambassador idea by half-seriously suggesting that the ambassadors should carry the passport of some other country, since in much of Africa a US passport starts you off on the wrong foot!

The new alignment of political power in the world must become more to us than newspaper headlines and TV reports, and for the American amateur radio operator, the reality of the situation is about to hit home. Don't expect any major expansions of the ham bands below 30 MHz at WARC '79, and don't look for any relief from foreign broadcasting. Instead, work for a maintenance of the status quo ... yes, work for it, by debating the issue and replying to the FCC's frequency allocation proposals, and by conducting yourselves like ham ambassadors on the air.

Frank Williams of the FCC's International Conference Staff is one of the most knowledgeable American experts on the 1979 WARC. Williams not only advised the FCC on its choice of frequencies for the various services, but has worked with dozens of foreign officials responsible for WARC preparations in other countries. Williams warns that individual amateurs, through their conduct on the air, can have great impact on foreign decision makers. He relates the story of a recent visit to 4U1ITU, the International Amateur Radio Club station in Geneva. In the presence of a telecommunications official from an African country, an off-color incident occurred on 20 meter SSB involving an American station. Williams didn't want to elaborate, but he says foreign diplomats are impressionable, and they don't only listen to 20 meters. Those stationed here in the US are the best their government has, and they are listening to amateur radio. Our conduct on the air could have more impact than a dozen amateur ambassadors, from what Williams told *73* in a lengthy interview.

Cutting Up the Pie

Aside from the international political situation, the list of services vying for frequency space is long ... aviation, private microwave, radio relay, AM broadcast, SW broadcast, fixed satellite, citizen's band, private land mobile, amateur, radio astronomy, auxiliary BC, common carrier, domestic land mobile, TV broadcast, maritime mobile, and more. That's 14 against 1 just for the attention of the WARC delegates! But what is the US doing about WARC?

WARC and ARRL

The answer depends on to whom you talk. FCC officials, at the end of intense work sessions which produced the final allocations draft, said they started back in 1972 in cooperation with the White House Office of Telecommunications Policy. The ARRL's involvement is controversial, with the league claiming its contribution started at the outset with a headquarters staffer in on the four member amateur subcommittee of the OTP advisory committee. The ARRL role was purely advisory, and focused almost entirely on the complicated series of committees charged with recommending an allocations table to the FCC. Except for the ARRL's relationship with the IARU, little was done on an international basis. Here at home there has been considerable in-fighting over WARC. In mid-1976, the entire ARRL Foundation Board of Directors resigned in protest after they were denied the right to work either within the League or outside it on WARC preparations. Amateurs who served on ARRL committees expressed deep concern that all wasn't going well, and questions about the use of League appropriations (set aside for frequency allocations work) continue to be stonewalled. *QST* has offered a steady diet of optimism ... although the November issue provided a first hint of the *real* story, with an editorial entitled, "Will Amateur Radio Exist in 1980?"

In an interview, Dave Sumner K1ZZ of the League's international staff outlined the ARRL's WARC

CARF

The Canadian Amateur Radio Federation (CARF) has reported to the DOC on recommendations for the 1979 WARC conference. The report includes a request that allocations be made for amateur operation below 10 kHz on a shared basis with other services, that 10 kHz be opened between 160 and 200 kHz for amateur use, that 40 meters be expanded up to 7325 kHz, along with 20 meters (expanded up to 14500 kHz), with status quo on 160, 80, 15, and 10 meters. The Canadian proposal also includes some new amateur bands, 29 meters (10100-10400 kHz), and 16 meters (18100-18500 kHz). The CARF document contains strong references against continued sharing with broadcast services on the 80 and 40 meter bands. 6 and 2 meters, 220 and 450 MHz are included, along with 1296, 2300, 3300, 5650 MHz and the 10, and 24 GHz bands ... along with 48, 71, 240, 165, and 300 GHz and up ... all for amateur use in the CARF proposal. The DOC, according to informed Washington sources, is expected to release its findings in late February.

CONFERENCES, CONFERENCES, CONFERENCES

The ITU is built on conferences. Conferences to call conferences ... and then another conference to call yet another conference. As complicated as it is, we can see similarities in other branches of international relations. How many times, for example, did Henry Kissinger do the negotiation shuttle? How many more sessions of SALT will be necessary before the next arms agreement?

Building up to WARC '79, there will be scores of conferences, at the national, regional, and international level. And one of the most critical areas for amateur radio will be the African and Asian conferences, not unlike one held last June in Gaberone, Botswana. It was the first IARU regional conference ever held in Africa.

To begin with, it was an International Amateur Radio Union meeting, and therefore was pro ham radio. But throughout the news accounts of the session there are signs of concern. As H. Walcott-Benjamin EL2BA, the President of Liberia's Radio Amateur Association, put it: "The amateur service is dependent upon the support of national administrations in order to obtain and maintain adequate frequency allocations. This has placed restraints upon the present day operation and future development of amateur radio ..." Walcott-Benjamin went on to list the constraints: "... lack of suitable frequencies capable of supporting communication during the usual day and yearly propagation variations, congestion and continuing interference due to the large and increasing number of amateur stations, and intolerable sharing arrangements with other services with a steady increase in the number of amateur stations expected to reach one million by 1982. The future of amateur radio now stands at the crossroads ..."

Mr. Walcott-Benjamin's words were not the only indicator of the rough road ahead; *Radio ZS* reported that there had been political discrimination which had prevented some (African) society members from attending the meeting. The South African journal went on to report that the conference showed evidence that there is little understanding of the problems faced by various African amateur radio societies.

It was those same problems that brought the African IARU delegates to Gaberone last June, in hopes of mapping plans to demonstrate amateur radio's usefulness to all of Africa. As *Radio ZS* put it: "Something had to be done to bring the importance of the decisions that would be made at the WARC to the attention of all member societies in Africa and to their various governments, as those decisions would influence the future of the amateur radio service throughout the world ..."

Among the resolutions adapted at Gaberone was a draft plan aimed at developing amateur radio in Africa ... specifically in Botswana, Lesotho, Rhodesia, Swaziland, and Zambia. It calls for IARU sponsorship of club stations in each country, improved availability of ham radio equipment, more visitation to the area by other IARU regional representatives, and, of course, another conference be held in early 1978, to solidify the African position prior to a pre-WARC session scheduled for Budapest.

efforts. According to Sumner, ARRL General Manager Dick Baldwin W1RU served as the fourth member of the amateur service committee (the remaining members were all FCC staffers, including Frank Williams, Prose Walker, and Merle Glunt – now an ARRL consultant). The committee draft automatically became the League position, with the emphasis on hammering out differences in committee instead of in public. As Sumner put it, "We felt it was far better to have a united front on the allocations than resort to public debate."

Three new HF bands at 10, 18, and 24 MHz were proposed in the ARRL (and FCC staff) report, but all of them were left out of the final FCC draft. Sumner says headquarters was disappointed by the Commission decision to leave them out, but isn't giving up. "We badly need them," Sumner told *73*, "for two basic reasons – increased propagation needs and the growth in numbers of hams around the world." ARRL, in its reply to the FCC draft, will apparently argue for the new bands in terms the Third World countries will understand. The earthquake last year in Nicaragua will be high on the list, with the argument that access to 10 MHz, for example, would have insured a reliable circuit after 20m had closed. The emergency was handled using 40m, but nighttime conditions made it rough. Sumner admits that if the new bands are allocated, hams will have to live with more sharing arrangements on HF.

Above 10m, the ARRL position was more or less a matter of keeping the status quo. Sumner pointed to two exceptions: the need for more satellite frequencies at UHF and the new 900 MHz band. In the ARRL view, 900 MHz could be a way of keeping CB off 220 MHz. Sumner says the League is constantly in touch with the CB industry, trying to persuade them that 900 MHz would be suitable for Class E CB. "If we can figure a way to convince them they want 900 MHz," says Sumner, "we could hold onto 220 MHz and realize net gain overall."

The Current Box Score

The reality of the WARC situation is best summed up by FCC official Williams, who says, "It's difficult to forecast ... nothing is really known about the other countries ... there are no hard proposals forthcoming from the others ..." Williams adds he's not totally pessimistic, since the world is not completely unresponsive to the amateur service, but he's not especially optimistic either. On the ambassadors, Williams agrees there has to be some kind of international public relations and healthy debate here at home. Most of all, amateurs must keep informed, he says, and be responsive to the FCC's plea for comments.

The FCC draft is the first made public in the world. Canada is expected to follow suit in February, but aside from those two, most of the 100 nations headed to WARC two years from now have not even started their preparations. A look at the history of previous WARC conferences shows the current lack of preparation to be about normal. And it can be interpreted to mean the trend of previous conferences will continue ... the trend of fewer HF allocations with an increased emphasis on SW broadcast, UHF, and the range above 10 GHz. The prime exception came in 1947, when the delegates set up the 15 meter amateur band, with sharing arrangements granted international broadcasting. It was not called the 15 meter amateur band, because ham radio was not officially recognized by WARC until 1959, when the conference voted to add the amateur service to the allocations tables.

"In mid-1976, the entire ARRL Foundation Board of Directors resigned in protest after they were denied the right to work either within the League or outside it on WARC preparations."

"Most of the 100 nations headed to WARC two years from now have not even started their preparations ..."

The FCC Draft

Elsewhere in this *73* Special Report, you will find a detailed breakdown of the FCC draft. In spokesman Williams' opinion, the amateur service came off quite well. He points to the new HF band between 160-190 kHz, downward expansion of 160 meters (although 100 kHz would be lost between 1.0 and 2.0 MHz), an improved SW broadcast situation on 80 meters up to 3.9 MHz (the 3.9-4.0 SW sharing arrangement would continue), an expanded 40, 20, and 15 meters, status quo on 10, 6, and 2 meters, some changes on 220 and 450, and extensive alterations (including a new band) above 900 MHz. A theme of the document is increased emphasis on satellite communications, with the lowest downlink frequency coming in at 6.950 MHz (the bottom of the proposal's new 40 meter allocation). Williams attributes the movement towards more satellite frequencies to amateur representation on the committees that drew up the original requests used to formulate the FCC draft, as well as the OSCAR program.

Between the Lines

Two issues remain unresolved by the FCC draft – 220 MHz CB and strong pressure from the aeronautical services for 146-148 MHz. The FCC table leaves, as primary allocations, mobile services in the 220 MHz band. FCC spokesman Williams echoes the sentiments of several commissioners, who've said publicly, "We may never make that decision." The FCC may never make *its* move, but the WARC will probably include the mobile allocation, setting the stage for future domestic debate. The question of aeronautical use of 146-148 MHz will apparently lie with the WARC, although pressure from within the US government was resisted at the FCC level. (One problem with the segment is the use of 144-146 in many other countries for repeater use, with the US actually in the minority in its repeater allocation at the top end of the 2 meter band.)

What's Next?

After the FCC comments period expires, the finishing touches will be put onto the draft, and it will become the official US position for WARC '79. Since it is the first made public, the FCC allocations are likely to become a platform for debate around the world. It may actually end up as a strong weapon in the hands of the Third World, which could be spurred into action by opposition to the US proposals. If nothing else, the FCC allocations table can be expected to stir debate, and the WARC story will begin to take on a more international flavor. But in the final analysis, only time and the complex web of international relations that links blocs of countries together will tell what WARC '79 really holds for amateur radio.

EXCERPTS FROM THE FCC WARC DRAFT

Amateur Service

The Amateur SWG (Service Working Group – advisory committees who proposed individual allocations for each service to the FCC) requested exclusive worldwide allocations between 160 and 190 kHz, 1715 and 2000 kHz, and 3500 and 4000 kHz; we can only partially accommodate these requests because of the requirements of other services operating in this long established portion of the spectrum. We are proposing to add the Amateur Service in the band 160-190 kHz on an exclusive basis. Exclusive allocations are also proposed between 1725 and 1900 kHz in Regions 1 and 3 and between 1750 and 1900 kHz in Region 2; we are additionally proposing an exclusive worldwide allocation in the band 3500-3900 kHz along with a continuation of the present allocations between 3900-4000 kHz.

The Amateur Service Working Group requested expansion of the Amateur allocations at 7, 14 and 21 MHz. Additionally, the SWG requested new allocations at 10, 18, and 24 MHz for the Amateur services. In both cases, wholesale relocation and reduction of existing Fixed services allocations would be required, with other services being affected to a lesser degree. In the presence of requests from other services whose needs we deem to be more pressing, we have not been able to fulfill the total requests of the Amateur SWG. We are, however, proposing some expansion at 7, 14, and 21 MHz, as set forth in the proposed table.

The Amateur Radio SWG requested that present allocations between 27.5 and 1215 MHz be maintained, that provision be made for Amateur Satellite operations in the band 220-223 MHz, and that Amateur operations be permitted in the band 902-928 MHz. At this time, no conflicts appear to the first two allocations requests. As the table shows, we propose to provide a primary allocation for Amateur Satellite at 220-225 MHz. Amateur operations in the band 902-928 MHz for Region 2 are proposed as a secondary service.

The Amateur Radio SWG requested that the present allocation at 1215-1300, 2300-2450, 3300-3500, 5650-5925 and 10000-10500 MHz be maintained. They stated that the relatively wide, but shared, allocations are necessary to permit experiments with wide band emissions and to prevent interference to/from users in adjacent bands. They also requested that a small segment in each of these bands be allocated to the Amateur Satellite Service in order to permit experimentation with space communication techniques. They pointed out that a 2304.1 MHz beacon was built into the OSCAR 7 satellite but could not be utilized for lack of an international allocation.

The Amateur SWG requested that the present allocations at 24-24.05 GHz and 24.05-24.25 GHz be retained and that the domestic allocations specified in Docket 19973 at 48-50, 71-76, 165-170, 240-250 and above 300 GHz be implemented internationally, because of the intensive interchange of ideas which takes place between amateurs in different countries. As our table shows, we are proposing no change to the existing allocations and also proposing additional allocations at 71-76, 165-170, and 240-250 GHz as in the Domestic Table. However, we are reserving the band at 48-50 GHz for Aeronautical and Maritime services.

Broadcast Services

The AM Spectrum SWG requested that the band 535-1605 kHz be continued as allocated to the Broadcasting Service on an exclusive basis, and that neighboring frequencies between 525-535 kHz and 1605-1805 kHz be also allocated in certain regions. As the proposed table reflects, we have added Broadcasting on a primary basis to Regions 2 and 3 at 525-535 kHz; we have continued the exclusive allocation at 535-1605 kHz; and we have added Broadcasting at 1605-1615 kHz on a shared primary basis in Region 2. While 1615-1805 kHz has not been included in the table at this time, additional spectrum space in this band for AM Broadcasting will continue to be considered in view of the potential heavy demand for new stations by commercial, non-commercial, and minority group applicants and in view of the direct public interest benefits of this service. The use of reduced

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Briefs

Compiled by Warren Elly WA1GUD

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At press time the news wasn't good for the Bicentennial Relay project. Despite weeks of trying, an appointment still had not been made to see President-Elect Jimmy Carter and deliver 45 messages of congratulations sent via amateur radio (five governors formally refused to participate). Carter was apparently too busy choosing a cabinet to accept the messages, although he did find time to, among other things, reply personally to a group of New Hampshire ski operators who were worried about competition from state-owned ski areas who'd requested federal aid. *The New York Times* reported Carter was getting out of touch, becoming isolated from the people. Meanwhile, Bill Miller K4MM, the prime amateur protagonist trying to get the appointment, had nothing new to report. "We're doing the best we can," he told *73*, but as time slipped by, it was beginning to look like ham radio occupied a lowly place on the new President's priorities list.

The relay was the idea of Eric Shalkhauser W9CI, a Bradley University professor who participated in the first Presidential Relay held in 1916. (Shalkhauser's series on the history of ham radio will begin in *73* with our next issue.) ARRL officials, QCWA officers, Miller, and Shalkhauser were to participate in the delivery, but unless the new President personally accepted the messages, ARRL officials reportedly would not be in attendance.

Messages from the governors, and the Mayor of the District of Columbia, were ready for delivery within two weeks of election day. The traffic was handled via OSCAR, RTTY, CW, SSTV, and SSB, with several governors offering their congratulations personally via 2m HTs. That attracted a lot of local press attention, but at press time the bottom line on the national level remained political red tape 1, ham radio 0.

The FCC continues its crackdown on illegal CB activity. Raids at Syracuse NY, Houston TX, Lima OH, and Columbus GA are among the latest. FCC Enforcement Chief Richard Smith told *73* the same pattern is coninuing, with amateur equipment and over-powered CB units confiscated, and users facing stiff fines. Indications are the FCC won't have any measure on how effective the program has been until summer 1977, but a survey conducted last year showed out-of-band operations on the increase while identification and license applications for legal CB were up. As the crackdown continues, FCC staffers in Washington are pondering plans to shut down the outlaws. A three point proposal was due to be submitted by year's end with a rule-making notice to follow. Banning the manufacture of all linear amplifiers capable of 11 meters, requiring dealers to see proof of license before selling gear, and type certification of all equipment were the prime recommendations. Amateur gear *would* be affected, although hams would not be stopped from modifying commercial gear or home brewing their own. Existing gear would be exempt, and manufacturers would be given a grace period to redesign their product lines.

The manufacturers (as you can expect) don't think too much of the idea. Robert Levine of Dentron told *73* he'd call about 15 manufacturers together at the SAROC Hamfest in Las Vegas in a bid to block any possible ban. "Illegal use of linears is a threat to ham radio as a hobby and to the livelihood of the manufacturers who want their equipment used legally," said Levine, who emphasized only major manufacturers would be invited to the SAROC session. (See Guest Editorial this issue.)

The ever-changing nature of the CB market has very nearly sunk a line of amateur products. Throughout the fall, persistent rumors in the industry hinted at the fact that Hy-Gain Electronics Corporation of Lincoln NE was in trouble because of a multi-million dollar commitment to 23 channel CB. With the emphasis on the CB market, amateur products were rumored to be in the process of being phased out.

Hy-Gain Amateur Products Manager Kip Kitterer admitted that with the emphasis being placed on CB, amateur products were placed in limbo with little in the way of advertising or development money being made available. However, early in December, a decision was made to remedy the situation. Hy-Gain was split into two completely independent companies. Hy-Gain de Puerto Rico, headquartered in Coral Gables FL, now has complete responsibility for all CB and scanners. Hy-Gain Electronics took over the Lincoln plant and handles the entire amateur product line of antennas, a new handheld 2 meter rig, and the 3750 transceiver. All marine and commercial land mobile equipment will also be manufactured at the plant.

Saying the company is now in the best position ever, Kitterer expects to broaden the product line. Four new VHF yagi antennas will shortly be available and the company will update and redesign its entire antenna line.

Despite the fact he's being used for false advertising and nondelivery of ordered items, Irael Treger W9IVJ of Trigger Electronics is still sending out catalogs, according to the Illinois Attorney General's Office. AG's spokesman John McPhee says he's pressing for a court injunction to stop the mailings, but is running into trouble finding witnesses. According to McPhee, most witnesses have been willing to sign affidavits, but are unable to appear in court. At press time McPhee was seeking the aid of local Chicago groups to find area people who'd dealt with Trigger. The mailings, meanwhile, have reportedly shifted in emphasis from newly licensed hams . . . to CBers!

WL2USA, the Thanksgiving weekend bicentennial operation at the Statue of Liberty, cleared 1200 contacts, according to organizer WA2NVG. Unfortunately, there weren't enough operators to cover all bands, as had been hoped for, and the station was only able to operate on 20 meters. Despite the problems, it's reported the project was a success . . . and quite educational in terms of dealing with government red tape and Murphy.

Don't look for many changes on the ARRL Board of Directors. After this past year's elections, five Directors were reelected without contest, along with two Vice Directors. In five other Director and Vice Director races, it was incumbents all the way, although some elections were closer than expected. In New England, for example, Vice Director John Lindholm W1DGL won by less than a hundred votes. The only surprises were the election of Don Miller W9NTP as Central Division Director (note this is not the Don Miller of Minerva Reef, etc.), and in the Roanoke Division, incumbent Vice Director Donald Morris W8JM was beaten by Gay Milius W4UG. *West Coast DX Bulletin.*

In what is believed to be first action of its type, a group of Southern California amateurs has voted to expel a member from its ranks. During a special meeting early in December, the Community Amateur Radio Service of North Hollywood voted in secret ballot to expel a Los Angeles member for reasons that he "has not demonstrated the level of maturity required for participation in a program serving a law enforcement agency . . . and has knowingly used the air for his own amusement in such a way as to lessen the pleasure of others."

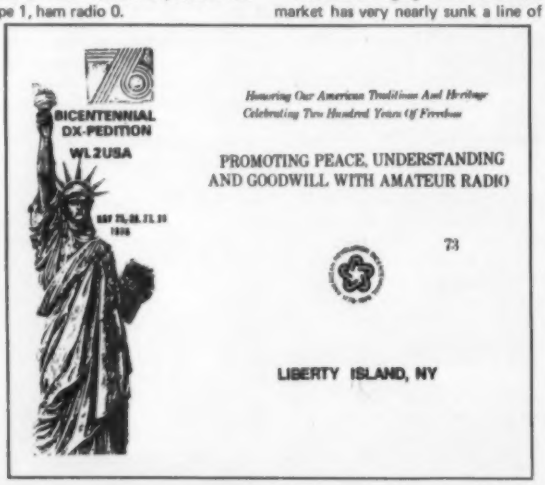
It was alleged that the expelled member had refused to remain on his assigned post when directed by net control, saying that he would rather go home. A recording was also presented showing that he had interfered with traffic handling during a declared emergency.

Members further said that the ham's primary form of self-gratification was his habit of harassing other operators who were operating legally. They cited cases of his breaking into QSOs to announce that he had nothing to say but had a "right" to interrupt.

Since the Community Amateur Radio Service is affiliated with the Los Angeles Police Department, members said his actions have brought shame or discredit to the group. The ham was expelled from the organization and his actions outside the organization condemned as being "a detriment to the amateur service." Adding salt to the wound, the membership further declared that he cannot be considered for readmission to the organization until he "has demonstrated that he has become a mature and responsible member of the amateur community."

The increasing numbers of people entering the amateur radio ranks has created a great increase in the amount of "questionable" practices, especially on repeaters. It appears that the action of the Community Amateur Radio Service, although the first, will probably not be the last attempt to clean up the airwaves.

The ARRL may be having some second thoughts about lobbying in Washington. According to a report in the *West Coast DX Bulletin*, the loss of tax exempt status by the National Rifle Association and Sierra Club was attributed to lobbying expenditures in excess of Federal limits. At issue is section 501 (c) of the IRS Code, which most interpretations say, allows 5% lobbying expenditures out of an organization's total budget. The ARRL board is reportedly considering



a major lobbying campaign anyway, with some directors saying the dollars lost if tax exempt status was revoked may be less important than fighting legislative and administrative actions affecting amateur radio. The stakes, however, are high . . . because some of the major advantages of AARL's tax exempt status are the major reductions in mailing costs for *QST* and in property taxes on the Newington CT headquarters.

Award-winning humorist, radio talk show host, TV broadcaster, film writer, and amateur extraordinaire Jean Shepherd K2ORS will soon be writing for *73*. Shep's latest accomplishments include a monthly column in *Car and Driver*, the TV play "Phantom of the Open Hearth" (recently broadcast nationally on PBS), and his long-running PBS series "Jean Shepherd's America." Several times the winner of *Playboy* magazine's humor award, Shepherd can be expected to produce some interesting material on ham radio, as anyone who's witnessed his hamfest talks can tell you. Shepherd's latest novel, "The Secret Mission of the Blue Assed Buzzard," about his Army career, is due this month. As the *New York Times* put it in a recent article on Shep, "He is a tribal storyteller, trying to explain us to us."

The bureaucratic red tape which permeates all levels of government has not failed to reach the FCC. In one recent incident, an Illinois amateur was threatened with administrative action against his license after a mix-up within the postal system.

John Maenpaa WB9JOJ of Dundee IL became entangled in the mess a year ago while conducting Novice classes. Five Novice exams were lost in the mail between Gettysburg and Dundee. All students subsequently received their licenses when another set of tests was sent, but that was not the end of problems. The FCC insisted that the tests that were never received be returned. Maenpaa told *73* that the FCC refused to acknowledge his reply and threatened action against his license.

At last report, the situation was still up in the air. Maenpaa said he has spent hundreds of hours teaching Novice classes and is now reconsidering his position, saying he only stands to lose his license if he continues.

Amateur licenses are really up, according to FCC spokesman Dick Everett. Everett told *73* the increase is "dramatic" . . . with a completely reorganized processing center at Gettysburg turning out exams and licenses in 8 to 10 days on the average. Two years ago ham licenses were slipping by nearly 300 a month. Now the total is up over 280 thousand . . . and climbing. Don't forget to use Post Office Box 1020, Gettysburg, when filing exams, renewals, and address changes . . . it's bound to speed things up.

The latest news from the Jet Propulsion Laboratory in Pasadena CA is that the Mariner pictures transmitted by N6V are now available on cassette. And club station W6VIO is still available for schedules to SSTV the Mars pictures, with special interest in providing the material to school groups. N6V's license expired in mid-November, according to club spokesman Jim Lumsden WA6MYJ. Jim tells *73* JPL is now working on next year's launch of M-J-S, Mars-Jupiter-Saturn . . . a fly-by flight. It is possible the vehicle will reach Uranus as well, with SSTV pictures and another special event call in the works. If you want the 60 minute SSTV cassette of the Mariner pictures, including the famous first photos from both the orbiter and Mars lander, send $3.75 to W6VIO, JPL, 4800 Oak Grove Rd, Pasadena CA 91103, attention R. Piety M/S 158-205. Schedules can be arranged by writing Jim Lumsden at the same address, M/S 233-103.

The United Nations inaugurated their new amateur radio station, K2UN, on October 21, 1976, which was completely equipped by Yaesu Electronics Corporation of Paramount CA. Impressive dedication ceremonies included worldwide contacts with amateurs in other countries.

Mr. Mohamed Mili, Secretary General of the International Telecommunication Union, is shown at the operating console with Mr. Max C. de Henseler HB9RS, President of the club's station, looking on. Mr. Harry Dannals W2TUK, President of the American Radio Relay League, Mr. Stan Zak K2SJO, Director of the Hudson Division of the ARRL, and U.N. dignitaries were on hand for the dedication.

The purpose of the station is to foster good will among the people of all nations in the world through friendly radio contacts in a hobby they share. The Yaesu Electronics Corporation provided three complete stations for U.N. use. Yaesu equipment is also in use at the headquarters of the International Telecommunication Union station, 4U11TU, in Geneva, Switzerland.

Antenna Specialists is offering a free antenna range calculator. A #10 SASE to 12435 Euclid Ave., Cleveland OH 44106, is all it takes.

The Long Island Mobile Amateur Radio Club (LIMARC) has taken to the broadcast airwaves with ham PR. WA2HYS, WA2DHF, and WN2DRO are producing a weekly show on WBAU-FM. The idea is to portray ham radio in unique ways, and it's apparently working. The station has signed the LIMARC effort for another 13 weeks, and several groups are considering use of the material on a national basis. If you're in the NYC area, tune in on Friday nights at 7:45 on WBAU-FM, 90.3 MHz.

A $75,000 prototype HF transceiver was stolen in the Ottawa, Canada area last summer, and the authorities apparently still have no leads. The rig was in Canada for a demonstration by the US Army. Although it is not classified, it does represent an extremely high level of miniaturization technology, according to a report in the *Ottawa Citizen*. Lifted from a National Defense station wagon parked outside a local motel, the transceiver is capable of operating on both the amateur and CB bands. *The Canadian Amateur*, Kingston, Ontario.

An amateur from Jacksonville FL has received the first single band Worked All States award for RTTY. The award, issued to "Big Al" Mitchell WA4HLP, was only the 18th WAS ever earned for the mode.

Mitchell used 20 meters and ran less than 100 Watts. At the time of the award, he had been a General for only four months, beginning his ham career at the age of sixty.

Faster and more accurate location of downed airplanes and illegal transmitters is the aim of a California group headed by Hartley Postlethwaite IV WB6CQW. The Happy Flyers (Hams And Pilots Piloting And Yakking) was originally formed to provide a group of qualified volunteers to be available during national emergencies and for public service. Since its formation, the group has branched out into ten "squadrons," primarily situated in the west.

Postlethwaite proposes to integrate the national repeater system into a network for locating downed aircraft. As a plus, the same system would make for easier detection of illegal transmitters and jammers. The Federal Aviation Agency requires all aircraft, from the smallest homebuilt to the 747, to carry an Emergency Locator Transmitter (ELT), which is automatically activated when a certain G-force is exceeded, as when a plane crashes. The ELTs transmit on 121.5 MHz, the international aircraft distress frequency. When the transmissions are picked up by any of the FAA centers located across the country, automatic alarms are set off. Unfortunately, many planes go down in remote or mountainous areas where the low power transmissions from the ELTs are almost useless. It may be many hours or days before the ELT transmissions are detected, often by a passing airliner that is flying too high to pinpoint any location.

Postlethwaite is proposing that all amateur repeaters be equipped with a 121.5 MHz monitor which would activate an alarm on the repeater if it received an ELT transmission for more than six minutes. (The six

Continued on page 118

New Products

TEN-TEC TRITON IV HF TRANSCEIVER

Ever since 2 meters, I've been looking for an HF rig I could take with me just like my HT and use mobile (where my 71 MGB-GT makes space a vanishing commodity). Those of you driving big cars may have bigger gas bills, but you've got me beat to heck on going mobile.

So, let's look at my situation, and consider what's available for HF portable/mobile. The list of self-contained mobile rigs isn't very long, not if I'm going to get into 20 SSB during the day, and 75 SSB at night. For one thing, I've got to have some power, and the ability to quickly change bands, preferably while in motion.

Enter the Triton IV. It weighs less than 12 pounds, measures just over a foot wide and four inches high by ten inches deep. The Triton IV is a no tune solid state, 200 Watt input, CW-SSB transceiver built at Sevierville, Tennessee.

It is the latest in a line of innovative transceivers made by Ten-Tec. Argonauts made Ten-Tec famous, and helped popularize QRP rag chewing, DXing, and just plain QRP hamming. Ten-Tec radios have attracted an intensely loyal following, and Argonauts have taken many a convert from the kW crowd.

The guy who got me interested in the Triton IV was Alan WA1MSK. He'd been regularly checking into 75 meter QSOs mobile with S9 signals, and there were often fixed stations having a much harder time. After hearing several of Alan's mountain-topping expeditions with Paul WA1VEI, the jealousy bug mingled with the mobile bug, and it was all over; I had to taste a Triton IV.

The Triton IV immediately gives away its lineage, because the Ten-Tec designers borrowed a lot of ideas from the Argonaut. One idea they left behind, though, was QRP: The Triton IV drove my SB-200 amplifier to full input with ease, and (using only the Ten-Tec and dipoles) DX, local QSOs, and nighttime schedules were handled nicely.

Mobiling proved to be most interesting ... my last mobile rig was an HW-32 ... and mobiling with the Triton IV brought back fond memories. The MGB's legendary ignition noise (second only to the infamous 280Z of W2NSD) was fooled by the Triton IV. Either I've discovered a new way of suppressing ignition noise, or Ten-Tec knows how to fool it (but I haven't cured the 2m rig, so it must be the Triton IV). An accessory noise blanker is also available.

The approaching Christmas holidays and Old Man Winter prevented a jaunt up Mount Monadnock or some other nearby peak, so my 12 V battery-powered DXpedition was scratched from the test. Instead I took the rig on holiday, threw up a wire, and proceeded to have a blast operating battery portable. All I packed was the Triton IV, mike, key, and dipole antenna ... and it all fit into a briefcase with room to spare! (Murphy helped me forget a 12 V battery, so I had to buy one at a local hardware store.)

The best thing about the Triton IV is honestly hard to pick. I know you're probably saying that's a put-on ... but it is not. The Triton IV is about the most flexible transceiver I've ever seen. I really like its *true* break-in CW ... just like VOX, but more. You can hear in between words – even characters. CQ QSOs are suddenly spontaneous, less stereotyped. The system really gives you an advantage in DXing, because you can slip your call in fast. (The transmit-receive switching is instant, and your QSO rate in contests is bound to improve.)

Tuning the Triton IV is easy ... switch bands and turn the carrier on. Peak the drive with the ALC LED, tweak the receiver to resonance, and away you go. (That's unless Murphy got your antenna!)

All no-tune rf amplifiers require a proper load, so unless your antenna is properly matched, no final (transistor *or* tube) is going to work efficiently. The Triton IV's transmitter is rugged; using Ten-Tec's ac power supply, it shut down automatically when faced with a bad match, but ran without strain into a good one. A front panel swr indicator on transmit doubles as an honest S-meter on receive.

Ten-Tec has made a lot of these Tritons and Argonauts. The hams there are dedicated and proud. Their owner's manual says a lot more about company philosophy than any other manuals I've read lately. "There are sufficient Tritons now in the field to indicate to us that there are several rather serious information gaps in ... the case of new technology such as solid state no-tune rf amplifiers. The main concern appears to be a matter of fundamental technical knowledge regarding swr, efficiency, and protective circuitry such as LAC and power supply overload protection." Ten-Tec goes on to list 10 points to keep in mind when using the Triton IV; most concern antennas and swr and the thrust is one of ham radio's cardinal rules: the better the antenna, the better the signal.

That company philosophy I mentioned earlier comes through in Ten-Tec's warranty statement as well. "The warranty is *not* voided for attempted repairs to defective units, the installation of additional switches, etc., when there is no change in the basic circuits." The final transistors are warrantied for 5 years, pro rata. A set of lab measurements came with our Triton IV test unit. On typical ham shack test equipment (power meter and monitor scope), the power output specs matched within 5 Watts, carrier suppression appeared better than reported, and, as the receiver specs indicated, no unwanted signals could be heard. The Triton IV was fun to use ... a pulsed crystal calibrator which attenuates incoming signals (nice), front panel ALC control, *full* break-in CW, sidetone monitor, two CW bandwidths with an optional filter, an 8 pole crystal filter, offset tuning, selectable sideband, excellent stability, 200 W input, and enough accessory connections on the back panel to run an amplifier and remote receiver (including muting). There's power for VHF-UHF converters (OSCAR anyone?), digital frequency readout (pre-wired for Ten-Tec's own unit), and a half dozen other Ten-Tec accessories, including a 160m converter and remote VFO.

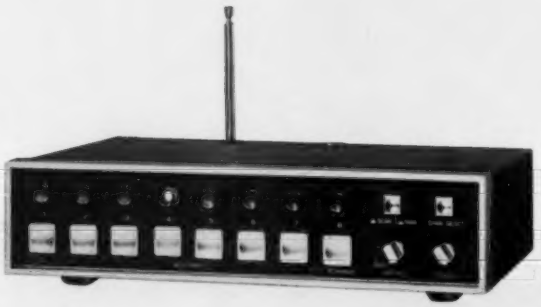
In short, the Triton IV does what Ten-Tec says it will. It's an attractive, reliable, flexible, all-transistor HF transceiver ... and it's got a lot of class. Ten-Tec Triton IV, price class $699.00, ac power supply $99. *Ten-Tec Inc., Sevierville TN.*

Warren Elly WA1GUD
Associate Editor

NYE-VIKING KEYS

CW is not dead. In fact, with the ever-increasing number of Novices entering the amateur ranks, and the recent extension of Novice privileges to Technicians, CW is enjoying an increase in popularity not seen since the day of the spark transmitter. The choice of keys is as wide as the quality of fists. They range from $1.49 mass merchandise varieties to high priced gold presentation models. For both the newcomer and the experienced brass pounder, picking the right key can be a frustrating job.

Much has been written about the pros and cons of straight keys, bugs, squeeze keys, electronic keyers, etc. Most hams, however, would probably agree that the old favorite is the standard straight key. One of the largest selections of straight keys available comes from the William M. Nye Company of Bellevue, Washington. In a time well known for products that are low in quality and high in price, the Nye-Viking line of CW keys and accessories stand out as an exception. They have eight separate straight keys ranging in price from $6.65 for the standard black and chrome to $13.50 for the top of the line heavy duty with a shorting switch. Their keys are



mounted on die cast bases and are available with brass, chrome, or nickel-plated hardware.

Both the beginner and old-timer will find the Viking keys a joy to use. Adjustment is easy and they have the solid feel that's necessary for serious CW operating. In fact, after a three hour session at the transceiver working the Novice bands, there was no evidence of the dreaded "glass arm."

Although the straight keys are the standard of the Nye-Viking line, they also make what are called the "Super Squeeze Keys." While they can easily be utilized as a sidesweiper, the Viking squeeze keys are designed for use with an automatic keyer. For the sake of nostalgia, Nye also offers a telegraph sounder for $28.00. Also in the Nye line are two matchboxes, retailing for $212 and $355.

Nye also told me that a new random wire tuner will be available about the time this article goes to press. It will handle full legal power from 2-50 MHz and will retail for below $300. Completing the Nye line is a heavy-duty low pass filter which sells for $19.95, and two phone patches, with or without built-in speakers. They retail for $44.50 and $36.50.

Some readers will recognize the Viking keys and matchboxes. The line was originally manufactured by the E. F. Johnson Company. In 1973, they decided to phase out their amateur products line and the William M. Nye Company purchased the design and manufacturing rights. Since that time, they've improved and expanded the line, adding the squeeze key to the original products.

The Nye Company is a small organization with a high quality, carefully built product line which should give the owners a lifetime of dependable service. In these days of mass production, that's a pleasure to see. *Wm. M. Nye Company, Incorporated, 1614-130 NE, Bellevue WA 98005.*

Stan Miastkowski WA1UMV
Associate Editor

MODEL TTLP LOGIC PROBE

Sylvanhills Laboratory's TTLP logic probe was designed to be used in testing logic levels that are either static or asynchronous. Since most counters, flip-flops, etc., change states on the trailing edge of the input waveform, the unit was simply designed to capture the negative-going pulse. And it uses a seven-segment LED display to tell you if the voltage is a logical one or a logical zero. If the voltage is 0 to .8, the display reads "0"; if the voltage is 2.2 to 5, the display reads "1". Simple as that!

The connections are even easier . . . connect the black lead to the ground of the system under test, connect the green lead to a 5 volt supply point, and you're all set. If you have power, a decimal point is displayed. Touching the probe to the terminal under test then gives you a logical 1 or 0. (Voltages between .8 and 2.2 give a blank display.) All in all, it's a simple and easy to use logic probe for the hobbyist or TTL designer. Options include an overvoltage protection circuit (should the probe be touched to a voltage as high as +24 V for several seconds), and a model TTLP-2 (with memory). The basic TTLP-1 is $19.95; the TTLP-2 is $24.95, and the "overvoltage protection" is $.75. By the way, this is a fully assembled probe, not a kit. For further information contact *Sylvanhills Laboratory, Inc., #1 Sylvanway, Box 239, Strafford MO 65757, 417-736-2664.*

Bob Lesch
Systems Manager

NEW SCANNERS FROM HEATH

Heath Company has introduced two new 8 channel VHF Scanning Monitors. The GR-1131 Hi Band Scanner and the MR-1134 Marine Band Scanner are designed to provide hours of exciting and informative listening.

The GR-1131 Hi Band Scanner monitors any combination of 8 channels in the "emergency services" band (146-174 MHz), automatically tunes in on police, fire, ambulance, U.S. Government weather broadcasts, and more. The GR-1131 scans each channel, stopping on any signal, and resumes scanning after the transmission. A priority channel feature checks the channel you're most interested in every 4 seconds and automatically switches to it if there is activity on the channel. Other features include channel lockout buttons, lighted channel indicators, automatic or manual channel selection, and a 4 pole crystal filter for good selectivity. For crowded signal areas, an optional 8 pole filter is available. It also features a built-in telescoping antenna and provision for an external antenna. Operates on either ac or 12 V dc. The GR-1131 is perfect for volunteer firemen, civil defense personnel, or just for listening.

The MR-1134 Marine Band Scanner is a valuable accessory for boat owners or anyone who lives near a harbor or lake. It monitors any 8 frequencies in the 156-163 MHz marine band, and picks up weather reports, marine emergency channels, harbor instructions, ship to shore and ship to ship communications, and more. The MR-1134 has the same deluxe features as the GR-1131, and includes a rugged splash resistant case ideal for marine use.

The two scanners are mail order priced at $89.95 and $99.95 respectively. *Heath Company, Benton Harbor MI 49022.*

NEW TWO-PALLET ALUMINUM TOOL CASE

Jensen Tools and Alloys has introduced a new tool case for the field engineer or technician who frequently travels by air. Constructed of jet smooth, seam free molded aluminum, the case weighs only eight pounds yet is strong enough to stand on. It is designed to resist abuse and take the hardest knocks of airline baggage handling equipment.

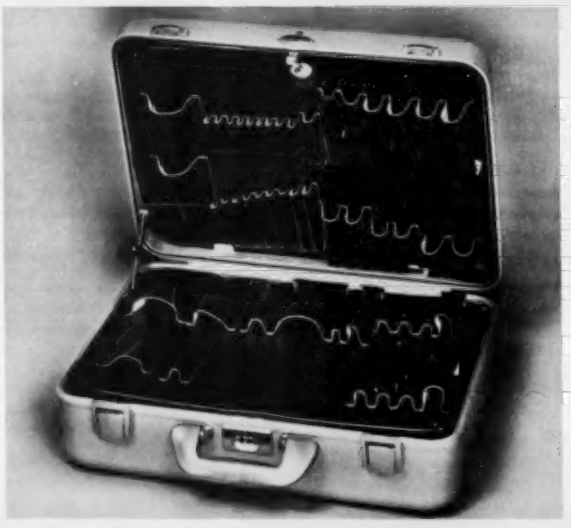
Among its features are a full length piano hinge across the back, a tongue and groove closure with a live rubber gasket to seal out moisture, dust and dirt, a document pouch inside the cover, and a keyless combination lock.

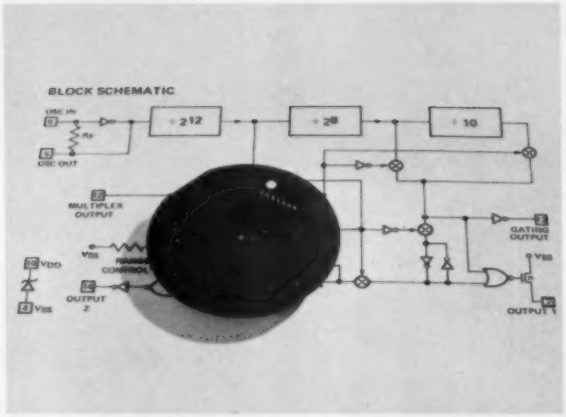
The bale-type latches are chrome plated and the matching handle is made of tough Tenite. The two removable pallets hold a full complement of tools and the pockets are both riveted and stitched for strength. Inside dimensions of the case are 17" x 12½" x 5".

The case sells for $145.00 with quantity prices substantially lower. To order, or for a free catalog describing other tool cases and tool kits, write: *Jensen Tools and Alloys, 4117 N. 44th Street, Phoenix AZ 85018 or call (602) 959-2210.*

AMPEREX VHF & HF AMPLIFIER MODULES

Amperex Electronic Corporation has a new line of VHF and HF amplifier modules containing internal matching networks for broadband applications. Two units, designated BGY32 and BGY36, operate at 68 to 88 MHz and 148 to 174 MHz respectively. Each module will deliver better than 18 Watts with a drive power of





less than 150 mW at a supply voltage of 12.5 volts. The input impedance and output impedance are matched to 50 Ohms with no instability into a VSWR of up to 3:1 over all phase angles.

Both the BGY32 and BGY36 will not be damaged with VSWRs of 50:1 through all phase angles at heat sink temperatures of up to 70° C.

The price for both modules is $52.50 in quantities of 1-9, and $44.50 in quantities of 10-99. Delivery of sample quantities from stock with production units available in 90 days. *Amperex Electronic Corporation, Hicksville NY 11802. (516) 931-6200.*

YAESU 24 HOUR CLOCK

A new precision clock which tells time anywhere in the world at a glance has been announced by Yaesu Electronics Corporation. The time in any principal city or time zone can be simultaneously coordinated with local time on a 24 hour basis. After the initial setting, as the clock runs, a Time Zone-Hour Disc advances automatically, showing correct time all over the world without further adjustment. The clock is especially designed to withstand shock, and may be hung on a wall or placed on its desk mount. The clock will run an entire year on a single 1.5 volt flashlight battery and the mechanism starts as soon as the battery is inserted. It measures six inches in diameter by two and one half inches deep. An excellent item for the business office, ham radio operator, short wave listener, boat owners and others who want an accurate, dependable clock. Priced at $30.00, it is available at all authorized Yaesu dealers in the United States. *Yaesu Electronics Corporation, PO Box 498, 15954 Downey Avenue, Paramount CA 90723.*

INTERSIL FREQUENCY COUNTER TIMEBASE

Intersil has broadened its line of timing microcircuits through the addition of the ICM7207A, a new frequency counter timebase. Used together with a 5.24288 MHz crystal and a 7 digit unit counter such as Intersil's ICM7208, the new circuit becomes a complete timer-frequency counter.

The new circuit is pin for pin compatible with Intersil's ICM7207; however, it has 0.1 and 1 second count enable window output.

When used with the ICM7208, the circuit's four outputs provide the gating signals for the count window, store function, reset function, and multiplex frequency reference. The 1 second count enable makes it possible to obtain 7 significant digits when measuring frequencies over 1 MHz with the least significant digit reading in Hz.

The ICM7207A will take crystals from 1 to 10 MHz, providing outputs at crystal frequency, and at $\div 2^{12}$, $\div 2^{20}$, or $\div(2^{20} \times 10)$ divider stages.

The new circuit has a stable HF oscillator, and it dissipates less than 5 mW at 5 volts. According to Intersil, the new circuit will be quite useful for applications requiring a system timebase, oscilloscope calibration generator, marker generator strobe, or frequency counter controller. The circuit is packaged in a 14 pin DIP. Dice are also available. Pricing is as follows: ICM7207AIPD 1-24 $6.60, 25-99 $5.35, 100-999 $4.40. Dice pricing is as follows: ICM7207A/D 25-99 $4.20, 100-999 $3.50. *Intersil, 10900 North Tantau Ave., Cupertino CA 95014.*

LARSEN KULROD™ MOBILE ANTENNA

Not unlike the proverbial search for an honest man, my search for the best mobile antenna has been fraught with peril. I've been led through radio stores, electronics catalogs, and dark alleys. I've tried gutter mounts that gut the finish, trunk lip mounts that creep off, and "super" magnetic mounts that fall off in a five mile per hour breeze. Couple those frustrations with a complete inability to obtain a swr below 2:1 and you have the stuff of which nightmares are made.

Finally, I can stay home nights . . . I can sleep peacefully and dream of rare DX. All because I've found it – the most nearly perfect mobile antenna that I can expect in this life. It's called the Larsen Kulrod™, made by Larsen Electronics, Incorporated of Vancouver WA. As far as I can see, Larsen manufactures and sells the most complete line of mobile VHF/UHF antennas available. It takes a few minutes to figure out the massive Larsen catalog, with its proliferation of mounts and whips, but no matter what type of mount you need or want, chances are they have it.

If you're at all like me, you've probably never been completely happy with your mobile mount. But happiness can be found here. A quick look at the chart of available mounts includes a strong gutter clamp model, a trunk lip mount, a trunk gutter mount, and two permanent hole mounts – the standard 3/4 inch hole and an absolutely beautiful 3/8" hole mount that can be installed with standard tools without the need for getting inside the car body. It's called a blind mount and will solve numerous installation problems.

The shining star of the Larsen mounts is innocently called the magnetic mount. So what, you say? You've seen plenty of magnetic mounts, most of them quite useless at speeds above 35 miles per hour since they exhibit a propensity for falling off. This mount is different. It's guaranteed to stay put at up to 100 miles per hour. (Professional race drivers, take note.) The magnet itself will lift 18 pounds, which is more than enough pull to keep it clinging tenaciously to the car. This feat is done by two methods, one using ultra-strong magnets that were recently developed, and the second by the very simple idea of increasing the mount's surface area. It works, and well. With the concern we all have for having our rigs end up in the hands of some rip-offer, the magnetic mount seems the logical choice for ultra-quick removal and hiding.

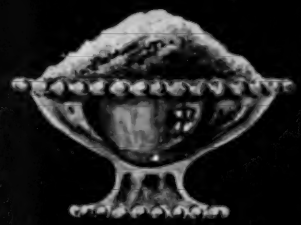
If the standard line of mounts isn't enough, adapter mounts are available for just about any existing antenna. All you have to do is screw the Larsen on and you're ready to transmit.

The whips themselves are available for any frequency from 27 to 500 MHz. They're made of the highest grade stainless steel and are coated four times to make sure no corrosion gets in the way of signal output. I made the mistake of trying to cut the whip with a pair of heavy pliers, something that can be done with most antennas. No way. The pliers wouldn't even make a dent in the surface. A vise and sharp hacksaw were needed. Following instructions, I cut the whip for 146.52, and was given a 1:1.1 on the swr meter. The 5/8 wave really punches out, even mounted on an angle on the small trunk of my car.

The situation was the same with the base loaded 6 meter whip. Pick your frequency, cut the whip, and see the swr needle move hardly at all. Best of all, my antenna-laden vehicle can be returned to an innocent antenna-free

Continued on page 140

The proof of the pudding is in the eating.



The proof of Triton IV is in owner satisfaction.

Here's some of the proof . . .

K4EME — This is my second TRITON IV. They are excellent xceivers! **WA8ICK** — Luv it. Dynamite! **W9NXU** — I am very thrilled with this unit, it is great. I think you have scooped the field. **WA0AYA** — I like CW and full break-in. (Beautiful) **K3TFU** — I love the unit. **WA3VEZ** — Rig is just great. Combined with your service makes a super transceiver. **WN0SED** — Beautiful radio to use. Magnificent CW filter! Just a pure joy. **WB1IT** — I have had my TRITON IV for two months and am delighted with it. **YN1MBV** — It is a very nice rig. **W3GTX** — New features very welcome. **W0BYC** — Bought one of the first TRITON II, like it so well I updated it with a TRITON IV. **W2TBK** — It is absolutely fantastic. **WB0OPI** — I am pleased with the rig. **WA3GJA** — Very-very-very nice. Good audio quality. **W5ZBC** — The most outstanding rig I have ever used. **K8CJQ** — Excellent rig, Good filters. **W7BKK** — Very happy . . . getting excellent quality reports. **W2CET** — Power-signal reports good. **WB2UEH** — I like the compactness and appearance. **VE3IBK** — An excellent rig with superior receiving quality. **K4IVM** — I think it is tops. **WA4LOG** — I've become so used to dip, peak and adjust, this TRITON is a beautiful new experience. **KL7IHW** — Easy to set up—works great. **K4JXD** — Seems to be very FB rig. **WA7KHE** — Fantastic performance. Thanks for a fine rig. **WB4BPG** — No problems—fine rig. **VE1BZ** — Good work. **W9HQT** — Receiver better than expected, CW break-in is super. **WQAP** — Tremendous transceiver. I appreciate your engineering. **WA2ZRO** — Wonderful. **K0SFV** — Real nice rig. You thought of almost every feature and built it in. **KQ9DQ** — Beautiful. **WB0JIQ** — Beautiful radio; however, your ads do not do justice to the radio. **WN5SOH** — Very sophisticated—Easiest tuning rig ever. Very glad I bought it. **K3OJV** — Very impressed. **W4LZP** — Very good results. Put out 100 watts as good as 300 watt rigs. **WA4DQY** — I think the TRITON IV is great. **W6QXN** — Appreciate full CW break-in. **W0INH** — Enjoy light weight. **VE3CYX** — I am extremely pleased with the clarity of receiver and after putting rig on the air, received unsolicited compliments on the audio quality of the transmitter. **K4PHY** — Was 3rd in USA, first in fourth district in WWCQ contest. **W8RYU** — Own Argonaut. Both fine rigs. **W4CDA** — Compact, light weight, good engineering. **WB2WZG** — TRITON IV is the most versitile CW/SSB radio I have ever used. **WB2FMV** — Outstanding. Highly pleased with performance. **WA8ACZ** — A real nice rig. I have owned about every other make. **W5EGK** — Works nicely. **WB4ECO** — I tried this rig, a pleasure to operate. **WA4YRK** — Excellent reports on audio. **WB8NKB** — Wonderful. **W9QPQ** — An excellent rig. Love it. **W8SOP** — Makes running SSB nets a real breeze. Also good on CW nets. **WL7IRT** — Fantastic rig. **W4MDB** — Has rekindled my interest and enthusiasm in Amateur Radio to an extent I hadn't thought possible. It far out distances any competitive product at **any** price. **W6EYR** — Very nice. Been a ham for 45 years and now solid state perfection. **W2RPH** — Excellent rig. **WN0TDK** — TRITON IV is a fabulous piece of equipment. **W5VIW** — Very nice rig **WB2LQF** — Wow! **W9JCV** — Tnx for giving us a FB piece of equipment made in the USA. **W8GHO** — Very pleased. **K4KXB** — Seems to have everything desired. **W4SZ** — A pleasure to operate. **W2FKF** — Greatest rig I ever had. So far in a month 34 QSO's without one miss. Been a ham since 1922. **W4GVC** — Nothing but complements. **WB9EZE** — Well pleased with performance and simplicity of operation. **K4ETI** — Rig is great. **W8CHV** — Man—! what a rig. I've had this call since 1929. Never saw anything like it and I've seen them all! **WB2MZU** — Seems like everything the S - - - - - O - - was supposed to be at one third the price. **WN0VHE** — I think it is a very good rig. **WB9FTD** — Break-in CW is very impressive. **K0CBA** — I believe it is one of the finest HF transceivers on the market. I can't tell you how pleased I am with the noise blanker. I can get on the air from my home station again for the first time in a few years. Other rigs with noise blankers just didn't hack it. **WA7YNW** — I am very pleased with this equipment. It is certainly of high quality. **W7IIA** — Excellent equipment. **WB0RWA** — Couldn't be more pleased with it. It certainly has performed beautifully and is all I expected and more. **WB4QJT** — Like it very much — keep up the good work. **WN1YVX** — Really impressed with looks and performance. **W0NC** — Very FB rig. Performs up to specifications, an excellent design. **K8PBZ** — Already have TRITON II and IV. **W7KD** — This little "T-4" is smooth as silk . . . I've received some very flattering reports about transmitter voice quality and the CW operation is the greatest. **WN8TTO** — I found that the TRITON IV was the best rig on the market for around $800. I love it! **W2JBK** — It is absolutely fantastic. **W8FEI** — Am amazed at receiver performance. I thought I had a top notch receiver with the H - - - - - - - - ! **W1FYM** — Your guarantee is refreshingly proper. **W8MOX** — Sure makes a guy look twice at his old tube type gear. **W1TFS** — Finest CW ever, CW selectivity very good. **WB6IVR** — Very satisfied with TRITON IV. Just what I was looking for to use on my yacht. Thanks. **WA8ONP** — Also have a TRITON II. I am pleased that Al Kahn and the **good guys** at TEN-TEC thought of the CW operator! **W2EMX** — Excellent Amateur gear meets and exceeds advertised claims. **W0AMJ** — It looks like there is nothing left to be desired. It is beautiful. **W6SE** — The receive function is outstanding. It is superb in transmit. **W1BV** — In love with this fantastic gem. It's so easy and a pleasure to operate. **W6ASH** — Very happy with performance. Particularly impressed with full break-in and light weight. **WA0IMS** — By far the best rig I have ever operated. I am glad I decided on the TRITON IV and not one of the other transceivers on the market. **WA8HQO** — Thank you gentlemen.

Add your name to the growing list. See your TEN-TEC dealer or write for full details.

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Tracking the Hamburglar

RIPPED OFF: Icom IC-22 2m transceiver, s/n 1311934. Stolen from vehicle in Regina, Saskatchewan on September 24, 1976. Contact Ed Berryere VE5GE, 1410 East Heights, Saskatoon SASK Canada S7J3BS.

TAKEN: Icom 22-S transceiver, s/n 0182. Stolen from my car. Contact Glenn Packard, 28 Bryan Street, Havertown PA 19083.

STOLEN: Icom 230, s/n 240686. Heathkit HA202 40 Watt amplifier – 2 meter, series #03608. Larsen JM 150 magnetic antenna. Taken from my parked car at my house, October 16, 1976. If found contact the Eaton County Sheriff's Department, or Robert Handy, 484-6300, or the Michigan State Police.

RUSTLED: Motorola Metrum II, #C064 with 94, 76, 88, 82, 67, 75, 85, 34, 70, 52, 91, 79. 1B PL. Motorola HT220 H23FFN #TP1174C with separate 12 freq t&r sw, 1BPL, TT on back, "custom WB9BVT" on rear. Robert Scott WB9BVT, 200 W. Chicago Ave., Oak Park IL 60302.

LOOTED: ICOM IC-22A #3405272 with "Kenneth Tendick" on rear, 94, 82, 88, 52, 79, 76, 67, 61. Kenneth Tendick WA9FQT, 1675 Von Braun Trl., Elk Grove Village IL 60172.

LIFTED: ICOM-22A #1827, wired for DV21, Motorola mike. Oscar Klein K9LTC, 18 W. 080 W. 14th St., Villa Park IL 60181.

ROBBED: TR22C #810284, sure mike, BNC ant jack. John Duval K9FIA, 4824 Francisco, Downers Grove IL 60515.

TAKEN: ICOM IC22A #4611. Edward Holz WB9FVG, 7927 S. Komensky, Chicago IL 60652.

KIDNAPPED: FT101B, s/n 316498 stolen in Dallas, Texas on November 25, 1976. Howard Vorpahl, 222 S. Marsalis, Apt. 210, Dallas, Texas, (214) 747-0991.

LIFTED: HR 2B Regency, s/n 49-01623, was stolen on November 26 between 5 & 6:30 pm from my auto parked in my driveway. Also taken was a Heathkit Micoder. My name and call were etched on the side of the inner chassis, and my call was etched near the power plug. A fuse holder had been added to the rear panel (Buss GMW sub-miniature). The light for the dial had been modified so that a short had to be made in the power plug to make it light. Thomas DiMilla Jr. W1VGZ, 8 High St., Saugus MA 01906, phone: 445-0050 8 am to 4 pm; 233-7541 all other times.

LOOTED: IC 22A transceiver, s/n 4611, taken from my Pinto at 4300 W. Roosevelt Road in Chicago on November 23, 1976. Cicero police report number 35310. It has all the standard factory crystals plus 147.45 in/147.75 out repeater set. Also in the set are crystals for MARS. They are 148.01 simplex and 148.01 in/143.99 out. Edward C. Holz WB9FVG, 7927 S. Komensky, Chicago IL 60652.

RUSTLED: 2m-FM transceiver, Regency HR-212 s/n 24-01253 taken from my car on November 23, 1976 in Coral Gables, Florida. Claude G. Edge W4PLZ, 1178 Firthview Drive, Melbourne FL 32935.

HIJACKED: Trio TR 2200 2 meter FM transceiver, s/n 621270, was taken on November 23, 1976 along with my 1976 Chevrolet Corvette. The transceiver was not in its case and had the on/off volume control removed and wired to the console of the car. If anyone finds both the car and radio, keep the radio and give me the car! Richard C. Bean WA1KDL, 103 Forbes Road, Westwood MA 02090.

Social Events

MANSFIELD OH
FEB 6

The Mansfield Ohio Mid Winter Hamfest Auction will be held February 6, 1977 at the Richland County Fairgrounds, Mansfield, Ohio. Prizes, flea market, auction – large heated building. Doors open 8 am. Talk-in 146.34/.94 and .52/.52. Tickets $1.50 in advance, $2.00 at the door. Contact Harry Frierhen K8JPF, 120 Homewood, Mansfield, Ohio 44906 or phone (419) 529-2801 or (419) 524-1441.

TRAVERSE CITY MI
FEB 12

The Cherryland Amateur Radio Club will hold its 4th annual Swap 'n Shop Saturday, February 12, from 9 am to 4 pm at the Northwestern Michigan College in Traverse City. A donation of $1 will include a chance on all prizes. There will be plenty of free display tables for whatever you may wish to bring in electronic equipment and parts. Everyone is welcome and a turnout of over 300 hams and experimenters is expected from all over Michigan. For more information please contact Bill Mader WA8WWM, at (616) 326-6392 or Box 2, Empire AFS, Michigan 49630.

WHEATON IL
FEB 13

The Wheaton Community Radio Amateurs will hold their 15th Annual Midwinter Swap & Shop on Sunday, February 13, 1977, from 8 am to 5 pm, at the DuPage County Fairgrounds on Manchester Road (near County Farm Road) on the west side of Wheaton, Illinois. Some tables will be provided, but bring your own if possible. WCRA invites anyone with an interest in buying or selling new or used electronic equipment to attend this hamfest, which will be inside large, heated buildings at the fairgrounds. Advance tickets (available until February 1) are $1.50, and tickets at the door are $2.00. Write Oran Hiscox WB9JJL, Ticket Chairman, Wheaton Community Radio Amateurs, P.O. Box OSL, Wheaton IL 60187. Commercial exhibitors should write Paul Sexauer W9JTO, at the same address.

GRIFFITH IN
FEB 19

The Lake County Amateur Radio Club's 24th annual banquet is Saturday, February 19 at 6 pm, at the Griffith Knights of Columbus Hall, 1400 South Broad Street, Griffith, Indiana. All the delicious home-cooked food you can eat, wine fountain, entertainment, guest speakers, special awards, door prizes, cash raffles and a dance band after. Tickets are $7.50 each: no door purchase. Write (prior to Feb. 3) to Herbert S. Brier W9AD (W9EGQ), 409 S. 14th Street, Chesterton IN 46304.

VIENNA VA
FEB 20

The Vienna Wireless Society annual Winterfest will be held at the Vienna Community Center. Indoor tables, sales, technical sessions, prizes and food. 8 am to 5 pm. Drawing at 3:30 pm. Admission is $3.00; tables $5.00. Information write Box 418, Vienna VA 22180.

NORWOOD MA
FEB 25

The Norwood Amateur Radio Club will be holding its annual auction on Friday evening at 7:30 pm on February 25, 1977 at the Norwood (Mass.) V.F.W. Post on Dean Street, Norwood. This is just off U.S. Route 1 south.

DAVENPORT IA
FEB 27

The annual Davenport Radio Amateur Club Hamfest will be held Sunday, February 27, 1977 at the Masonic Temple in Davenport, Iowa. Admission is $1.50 advance – $2.00 at the door. Talk-in on 28/88 and 52. Refreshments and tables are available. For info and tickets send SASE to Dick Lane WAØGXC, 116 Park Avenue, So. Eldridge IA 52748.

LIVONIA MI
FEB 27

The Livonia Amateur Radio Club would like to announce that the 7th Annual L.A.R.C. Swap 'n Shop will be held on Sunday, February 27, 1977, from 8 am to 4 pm, at the Stevenson High School in Livonia, Michigan. There will be plenty of tables, door prizes, refreshments, and free parking available. Talk-in on 146.04/.64 and 146.52. For further information, write Neil Coffin WA8GWL, c/o Livonia Amateur Radio Club, PO Box 2111, Livonia MI 48150.

LAPORTE IN
FEB 27

The LaPorte, Indiana ARC will hold its Winter Hamfest on the 27th of February, 1977, beginning at 8 am (Chicago time) at the LaPorte Civic Auditorium. Good food, plenty of free tables, 50 miles east of Chicago. Talk-in on 01-61 and 94, donation $2 at the gate. Information from LPARC, PO Box 30, LaPorte IN 46350.

MARSHALL MI
MAR 5

Michigan Crossroads Amateur and Computer Hobbyists Fleamarket, Junction I-94 & I-69, at the Marshall High School, Junction I-94 & I-69, Saturday, March 5 from 8 am to 4 pm. Forums and YL tours! Sponsors: WB8QQU (MHS "AMPS") and W8DF (SMARS, Inc.). For more information K8UCY – 616-781-3554.

STERLING IL
MAR 6

The Sterling-Rock Falls Amateur Radio Society will hold its hamfest on Sunday, March 6, 1977 at the Sterling High School Field House, Sterling IL. Contact Don Van Sant WA9PBS, 1104 5th Street, Rock Falls IL 61071 for tickets. Advance donations $1.50, door donations $2.00.

PHOENIX AZ
MAR 6

The Winter Hamfest will be held March 6 at South Mountain Park at the south end of Central Avenue, Phoenix. Featuring swap meet, eyeball and pot luck. Sponsored by the Amateur Radio Council of Arizona.

BRIDGMAN MI
MAR 6

Blossomland Amateur Radio Association will hold the 11th Annual Spring Swap-Shop, Sunday, March 6th at Bridgman Middle School gym, Lake St. at Tower, Bridgman, Michigan. Exit 16 on I-94. Expanded facilities, refreshments, prizes, and fun. Talk-in on 22/82 and 94. Table space restricted to radio and electronic items only. Advance ticket donation $1.50. Tables $2. Write: John Sullivan, PO Box 345, St. Joseph MI 49085. Make checks payable to Blossomland A.R.A.

WHITEWATER WI
MAR 20

The Tri County ARC (Whitewater, Wisconsin) Hamfest will be held March 20, 1977 in the Whitewater Armory. Donation: $1.50 in advance, $2 at the door. Reserved tables $2 in advance. Write Doc Walters WB9EMR, 81 N. Main Street, Fort Atkinson WI 53538.

MAUMEE OH
MAR 20

The Toledo Mobile Radio Association, Inc. is sponsoring its 22nd

Continued on page 48

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Looking West

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"I have spent 15 years of my life getting what I consider a good operating repeater working and reliable and I can't stand to listen to it." These were the words of Burt Weiner K6OQK, licensee of the Los Angeles-Mount Wilson WR6ABE repeater (probably the world's busiest and most heavily populated open two meter repeater system), to one of his head control stations, Bob Thornburg WB6JPI. Burt continued, "Unless you want to take over the mess, I will turn it off forever."

The foregoing information was contained in an open letter mailed to almost a thousand users of the WR6ABE repeater explaining the reason that its new operations director, Bob Thornburg, would be removing WR6ABE from the air for a two month "cooling off" period and outlining what operation on the system would encompass when it returned to full time operation on the morning of January 1, 1977. Bob's letter continued to detail the reasons behind his decision. "Over the last several months (years), various techniques have been tried to correct the operating practices of certain individuals. None have been universally successful. At the present time, about 12 people dominate the repeater, almost all from base stations, and all operate without significant regard for other users. Not that their operation is grossly illegal in the FCC sense; they ID and will occasionally even let breaking stations through, but their conduct, language, and subject matter are, in general, deplorable and obnoxious, or at least selfish. The overall complaint could best be described by stating that these individuals use the repeater for their own platform. It is their only outlet for their mental frustrations (which appear to be extensive). They are parasites in that they use the repeater (and some users), rather than utilize the repeater to talk with its users."

From this, you might have a rough indication of the level to which things on ABE had deteriorated. While it's true you cannot be the biggest without expecting to suffer some trouble now and again, ABE was in the past few years getting more than its share. If one was at all observant over this time period, the continuing decay was easy to note. Trying to break, even to contact another station and QSY elsewhere, had become at times an impossible chore. Many of its regular users, a good number who had been a part of its operation from its days as WA6TDD, had gone elsewhere as the problem children began to grab hold of the system. This apathy on the part of a lot of amateurs, their unwillingness to stand and fight along with the licensee, was in my mind one important contributing factor to the overall decay. The unwillingness of the well-mannered operators to take on at least a part of the solution to this growing menace was still another.

By October of this year, typical day-to-day operation of WR6ABE had become a game of which high-powered duplex base station could capture whom, which one could best cover up the incessant and ever-present jamming and, in the end, which station could best monopolize the repeater's air time while saying the least. While technologically the finest open system to be found anywhere, operationally it had reached its lowest ebb.

Why, you may ask, did the licensee do nothing about the situation? You have to know Burt as I do to understand. He is one of those one in a million super nice guys whose path you are fortunate enough to cross during your lifetime. He sincerely cares about the feelings of others and wanted to have his repeater represent his personal attitudes. He wanted it to be an easy-going place where people could chat with one another, get to know one another, make friends, and above all, have fun with amateur radio. For many years, that's the way it was. I remember it being that way when I first moved here almost five years ago. No matter how busy, it was always a place where user respected user, and where pride ran high.

Then along came a new breed of amateur, the kind of amateur who believes a repeater is a gift from on high, put there for him to use as he wishes without any regard for his fellow human beings, be they other users or the system licensee. It takes only a few people such as these to wreak chaos on any repeater and such was the case here. However, Burt felt that the good would triumph in the end and placed his trust in the "good users" to clean up the system. Unfortunately, very few were willing to assume this responsibility. It was easier to just go to another repeater and let the "channel hogs" have their fun.

Without total public backing from the majority of the usership, which was not to be had, Burt apparently reached the conclusion that the best way to solve the problem was to take the system off the air and write off 15 years. That is, unless someone else was willing to try and solve the problem and clean up the mess. WB6JPI agreed to try. How? Bob's letter continues: "My first act is to remove the repeater from the air for 60 days. My analysis of our parasites has indicated that they need and require a host. Removing the repeater from the air will require them to seek another host. They will migrate to other repeaters and with luck they will like it there and stay there. (Editor's note: Virtually every other area repeater has a much higher degree of regulation and discipline and, in my opinion, a takeover of another system in a like manner to the ABE takeover is not likely. Not to say that it might not be attempted, but rather the likelihood of success is small.)

"The repeater will be forced to behave. A tight group of control operators will be trained and ordained. This group will have the power to enforce (by various means, including shutting off the repeater) certain rules on the operation and behavior that will be used on the repeater. Subject matter will be censored, as well as language and operating procedures. Freedom of speech and 'right to use' will have no precedence. The decision of the control operators is absolute and without appeal. If you don't like it, use some other repeater. This excruciating, difficult, arbitrary, and strict control will last for as long as it takes. It is hoped that out of the war will emerge a group of users with an attitude and behavioral pattern that will set a new standard for ABE. Those who are attracted to a tightly controlled repeater will survive and continue demanding from new users a high level of performance. Therefore, it is hoped that the tight control, censorship, and other direct user controls will only be necessary for a few months. It will be self-perpetuating. In a few years, the cycle may have to be repeated. It may not always work.

"Again, ABE is trying something new – user attitude adjustment. To my knowledge, it's never been done. We have a good 'handle' on jammers and jammer-related problems and I feel that Paul W6AOP and his team can thwart the threat of unidentified illegal and destructive use of the repeater. Tight control will be established to ensure that the 'legal' users will behave. If it doesn't work to my satisfaction, then indeed ABE will go dark."

User reaction on ABE as well as other repeaters was interesting to note. It ranged from, "This is a public utility and you have no right to do this" (editor's note – while this kind of statement might seem as absurd to you as it does to me, nevertheless it was indeed heard time and again as a reason why the owner was obligated to keep the repeater in operation), to "Maybe I'll sue; after all, I had to buy a special set of crystals to operate this repeater and now they're no good." It included, "We'll put up a repeater of our own on this channel pair," and, of course, "You can't tell me how to operate my station or what I can say on this or any other repeater; I'll say anything I like ... it's my right." There were more; these are just a few of the ones that still stand out in my mind. It was quite obvious that those making these statements had never taken the time to read the rules and regulations; they failed to realize that this and/or any other repeater they would chance to operate was there through the benevolence of another amateur who, through the goodness of his heart and technological skill, had in effect invited other amateurs to share the use of his station. For indeed, what is a repeater other than another amateur's station there for you and me to use?

While many users did voice support for Bob's decision both on and off the air, a lot of times the tone of voice made you wonder if the gesture was half-hearted. When I would hear such statements, I would wonder why people had waited till now to make them. Why had they not taken affirmative action themselves long ago to remedy the situation before it had gotten this bad? Could it be that deep down inside they were mad about losing use of the system regardless of how bad operating procedure had gotten? I still wonder. Oh, there were some sincere "well-wishers," but they were far from the majority.

Reaction elsewhere on other systems was quite interesting. For a long time, other systems had considered ABE as the "jail" that housed the outcasts from two meter FM society. As long as ABE was there, everyone was safe. Now the "jail" no longer existed and a number of systems took interesting action. A few announced that they would be going either part-time or full-time tone access while others went to revised operating schedules. A number of previously 24 hour systems now shut down at midnight or thereabouts, when no control operator is present, while others have announced that control stations are continually on duty. While no one will admit that ABE's going away is the reason, it seems very coincidental. Anyhow, the amount of malicious jamming being suffered by various systems seems to have increased since ABE went dark. The jammers are not to be confused with amateurs who abuse the privilege of operating a repeater; they are two entirely separate entities, two entirely separate problems. These problem causers seem desperate to find new homes and new audiences, and to thwart this, a good number of systems have *"ordered"* their users to pay no attention whatever to this problem, thereby taking away the audience factor. In reality, this is the best and many times the only weapon to use against illegal malicious interference.

The big questions seem to be: Can the directorate of WR6ABE succeed in changing the operating habits of a large number of amateurs and instill in that group a sense of total pride and respect for their fellow amateurs? Also, do they have any right even attempting this? To answer the latter first, indeed they do. Their obligation is clear and that obligation is not only to amateur radio but to society in general. With the advent of the $9.95 public service monitor portable radio, there is no telling who your audience might be. We must always assume that someone without the understanding of amateur radio is listening and be aware that saying the wrong thing might offend and alienate that kind of person. We need friends, not enemies, and if this means that we must clean house once in a while, then it best be done.

Then, too, is the fact mentioned earlier that a repeater is not a God-given gift, but rather like one amateur inviting you into his shack to use his station. If you used his station in a manner he deemed improper, he

would ask you to stop. If you refused, he would probably pull the plug out of the radio rather than permit this transgression to continue. By the same token, there is no obligation on the part of any repeater to adhere to the will and directive of its usership unless it happens that the sponsor of the system is a club corporation and the membership comprises the shareholders. Then and only then do users have the right to voice any opinion in the operational parameters and guidelines of the system. In the case of the individual owner-licensee, there is no obligation to provide any form of service to anyone at any time. It's up to him to decide when it will be on the air and how it will be operated. It's what one might term a benevolent dictatorship. A repeater owner has zero obligation to users; however, users have specific obligations to adhere to the wishes of the licensee. After all, in effect you are in his home; you are using his station.

Now I can hear a lot of teeth grinding and see a lot of fists clenched by people who are saying to themselves, "How can he say that? He's selling users down the tubes; why, it's we users who are the most important aspect of any repeater; we support the repeaters; we are the people that by virtue of our use of a repeater give it a reason to exist." However, after this anger wears off, I ask you to sit and think as I did and ponder the following: Your license gives you the authority to operate an amateur station, your amateur station, on a certain portion of the electromagnetic spectrum. The portion of the spectrum you are permitted to operate is governed by the class of license you hold. No where in the rules and regulations that govern your license does it say that your license or mine gives us the right to walk into the home of another amateur, without his permission, sit down in front of his amateur station, and make use of his equipment against his will. If he does not want you in his home, he has a perfect right to tell you or me to get lost. Our licenses give us the right to respectfully share the allotted spectrum with others on a non-interfering basis. Our licenses do not give us the right to operate a repeater just because it is there; we have the right only to use our radio to transmit on a given frequency, be it a channel set aside by local agreement as the input of a repeater or not, and there is nothing in the rules that states we must be repeated or relayed via a repeater. That is left to the sole discretion of an individual who happens to hold license on a repeater. As users, we have the right to own and use radios; being repeated is a privilege, unless you either own the hardware or part thereof or hold the license. You and I constitute a subculture known as the "repeater user," and our only "right" is the right to say thanks now and then to those providing repeaters as a service to us. It's a hard, cold fact of life, and one that you do not consider until the day that your favorite repeater goes away.

The next question: Can the concept of user attitude adjustment as outlined in Bob's letter succeed? Can the attitude of "me first" and "I have more right to be here than you" be replaced by a willingness to work together for a common good? Can the human nature of a few be changed to benefit many? When ABE comes back on the air, will it be greeted by a group of enthusiastic people, eager to build a new world with a goal of a new standard of excellence in repeater operation and thereby setting a new standard for a nation to emulate? Or will the promised vendetta of a few selfish people force the final decision to be made, the decision that would spell an end to more than 15 years of WR6ABE and possibly signal an end to open format relay communication elsewhere? Many repeater people, both owners and users, will be watching this experiment, and once more it looks as if Southern California is about to set another trend. Will it work? Only the future will tell.

Last month we introduced WR6AKG and Keith Glispie WA6TFD to you. Keith is the young amateur who saw a need to provide children of school age who happen to hold amateur licenses a place of their own to communicate. Out of this need WR6AKG has been born. As of this moment, November 20th, Keith is busy at work readying his PYE Communications Model FM-50 repeater for service. While the SCRA has yet to confirm a final channel pair for this endeavor, the inverted split-split channel pair of 146.925 in, .325 out looks like it will be AKG's home. This channel pair is currently occupied by a private system in Palos Verdes, the owner of which, I have been informed, has agreed to co-channel with the AKG project. The only thing holding up final test sanction is that the output of a privately owned remote-base also utilizes .325 as a two meter downlink, and unlike repeaters, remotes are not SCRA coordinated. An organization known as the Southern California Repeater and Remote Base Association handles coordination of anything on 60 meters and 450 on up. Therefore, it is necessary for SCRA to contact SCRRBA and in turn have SCRRBA contact the remote owner in question and request that he either also agree to co-channel with AKG or that he agree to re-coordination to another two meter channel. It is this final step that Keith now awaits. Will the remote agree to co-channel with what might become one of the area's busiest open repeaters from sunrise, well . . . to sunrise, I guess? We should know soon.

However, with things starting to look quite positive after almost two years of work, the following letter went forth to all school radio clubs within the Los Angeles Unified School District from DHART, AKG's sponsoring organization.

ATTENTION ALL AMATEUR RADIO CLUB MEMBERS, WHETHER LICENSED OR NOT!

The Dorsey High Amateur Radio Team (DHART) is proud to announce a new idea in amateur radio. The idea is to invite all members of Junior High, Senior High, and even Collegiate and Vocational Schools to join us on two meter FM. If you are saying to yourself the idea is not new, listen further.

A new repeater system, licensed to the Los Angeles Unified School District, through WA6TFD, will be in service within 2 months. Ah, but this is only part of it. About 2 years ago, DHART found that there was a valuable need to keep in touch with other radio clubs at other schools to keep up with the new ideas, projects, etc., that another club may have. So we talked to several other schools, who also agreed that there should be something done. Some schools had tried to give their young hams a chance to get into 2 meters and the idea of "repeaters." Amateurs already established on repeaters didn't exactly see eye to eye, so the newcomers felt rejected and lost interest in repeaters.

With all comments and ideas in hand, and with help from outside organizations such as PARC, members of DHART set out to find the solution, and that was to have a school "interlink" repeater system instead of just one channel talking directly to one school at a time. Since some schools are situated in remote portions of the county, simplex operation at times would be very difficult. With this in mind, we set out to build WR6AKG, a repeater which was built from bits and pieces from everywhere. It was finally completed after long hours of hard work.

We found that it would almost be impossible to find a repeater channel, but we went ahead and tried anyhow. We wrote the SCRA and told them that we wanted to put a repeater up on two meters and that it would be used as a school interlink system. They sent us a letter back saying that the band is quite full and that they would try to find something. About two days later, we received a call from the SCRA saying that they were trying very hard to find an open channel on which to put our machine.

They were pleased to finally see a repeater go up in this crowded system that finally had a purpose, and that purpose is to stimulate amateur radio interest and promote student communication between themselves and between schools.

This, in other words, is a pilot project which has never been tried before and will be the first of its kind anywhere. Fellow hams, this is *your* machine. It is provided for *you* to stimulate *your* interest in amateur radio. If you want to, set aside time for code practice, operating procedures, radio club rag chew, IC logic lingo, etc. The list goes on and on. Remote control operations, crossbanding, low band operations, field days, etc. Invite your friends who are not hams or even CBers to join you and find out what amateur radio is all about. Handled just the right way, your school can have more hams than you can deal with! You never know what can come about!

DHART hopefully will have WR6AKG in operation before December. The test location shall be in the Baldwin Hills area, with 50 Watts transmit power and .2 microvolt receiver sensitivity. We are trying to get the site atop Mt. Wilson at channel 58 for all-around coverage. The repeater frequencies at this time are unknown, but you shall be notified as soon as we are. If you would like to find out more about this program, give suggestive comments, or find a 2 meter FM radio for your school, contact the control operator of WR6AKG, Bryan Glispie WA6TFD, 3861 2nd Ave., Los Angeles CA 90008, (213) 295-0721 or DHART, 3537 Farmdale Ave., Los Angeles CA 90016, (213) 296-7120 Ext. 1.

If you have 2 meter equipment that may be used by other schools, please call DHART and we can list your school as a source for a radio.

If you have any suggestions or donations please contact us.

Yours truly,
Club Advisors
J.A. Martin
Traci Campbell

While amateur radio and amateur radio clubs have been around both public and private schools probably since the inception of amateur radio itself, this is the first time (to my knowledge) that it may play as important a part in children's education as now seems possible. The potential for the concept that the Dorsey High Amateur Radio Team is pioneering might just go down in amateur radio history as one of its finest hours. I personally suspect that it will be one quickly emulated elsewhere. My hat is off to Keith Glispie and DHART for finally giving a real purpose to amateur relay communication and thereby bringing amateur radio a bit closer to the non-amateur world. From this only both can profit.

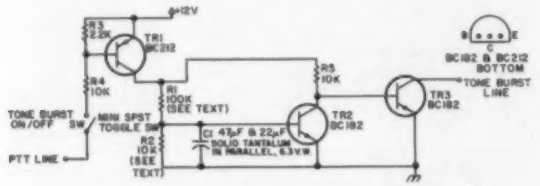
Calling all boats, calling all boats! Planning to sail or power your way into Los Angeles Harbour or Marina Del Rey? If so, it might pay to put 146.805 – 146.205 in your two meter radio. This inverted split-split channel pair is the home of WR6ACK, a newly redesigned repeater system whose purpose will be providing inter-boat and boat to land communication for aquatic oriented amateurs.

If you have been following Looking West for any length of time, you might remember a few years back when ACK was Los Angeles' first open autopatch and also the first open

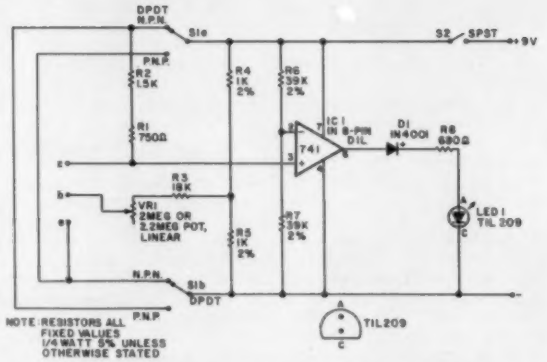
Continued on page 31

Circuits²

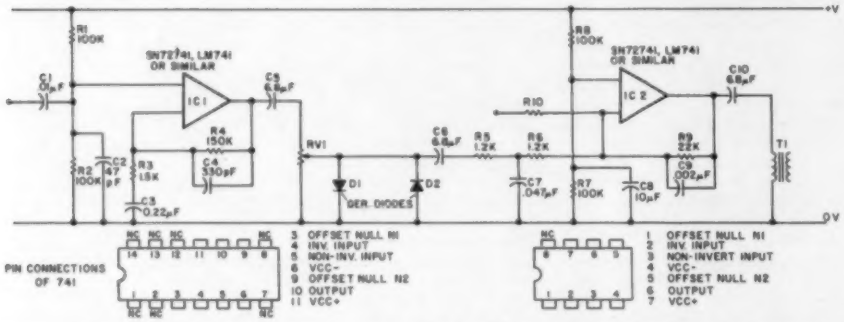
Want a free copy of any 73 publication? Sure you do. Just send in your favorite circuit, or even one that you don't especially like. If we print it, you take home the book of your choice.



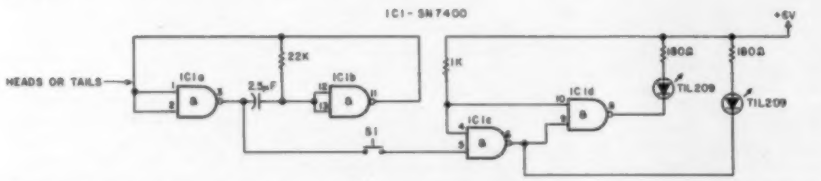
A tone burst timer for the Kenwood TR-2200A, with the length of the burst determined by the values of R1 and R2 so long as their ratio remains 10:1 (i.e., 100k:10k, 150k:15k, etc.). The burst length (with illustrated components) is about 400 milliseconds using a 12 volt supply. Reprinted from International Mobile News.



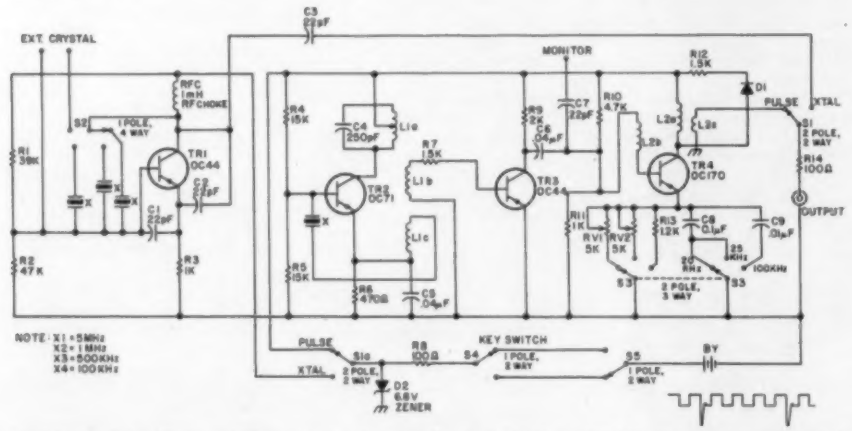
Simple transistor tester. Indicator lamp LED 1 is fed from the output of the op amp via D1 and current limiting resistor R8. D1 is included because the output of the op amp, when it is fully negative, is about 2 volts positive. Without D1 that would be just enough to produce a visible glow in LED 1, but with the voltage delay D1 produces, the LED is fully doused when the op amp output is negative. Reprinted from Practical Wireless, *England.*



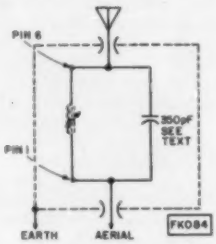
Speech-amplifier clipper using the 741 op amp. As shown, the unit will deliver about 30 V peak to peak output, but can be easily modified for less output by decreasing R9 and increasing C9. What's more, T1 can be eliminated to cut output to 15 V peak to peak. Reprinted from The Short Wave Magazine, *England.*



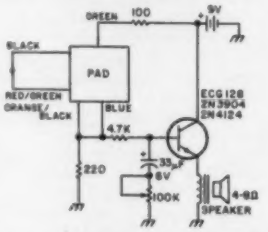
Low cost "heads or tails" game. S1 must be a push to make, release to break, switch. Thanks to D. Manoharan, Kuala Lumpur, Malaysia.



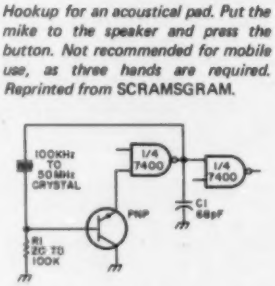
Crystal-controlled calibrator which generates pulse type signals at 20, 25, or 100 kHz. The unit covers the whole spectrum into the VHF region. Reprinted from The Short Wave Magazine, *England.*



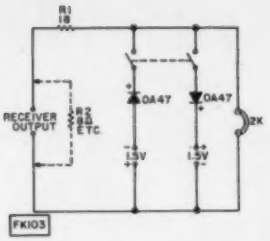
Tone cut control, for reducing the level of heterodynes. Also useful in compensating for deficiencies in small speaker systems. For best rejection of an unwanted signal, aim for minimum capacity and maximum inductance. Connect the trap as close as possible to the receiver antenna terminals for highest efficiency. Reprinted from Practical Wireless, *England.*



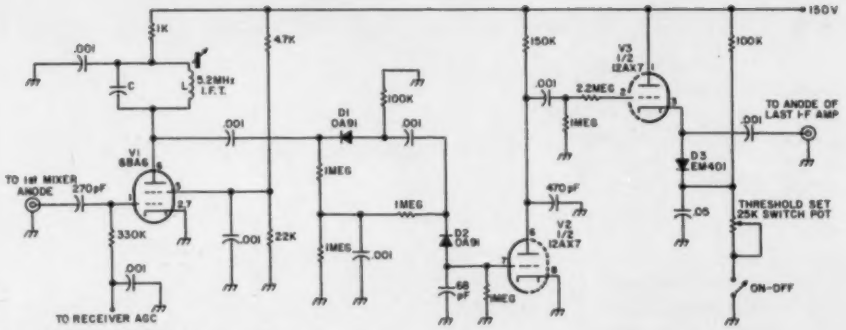
Hookup for an acoustical pad. Put the mike to the speaker and press the button. Not recommended for mobile use, as three hands are required. Reprinted from SCRAMSGRAM.



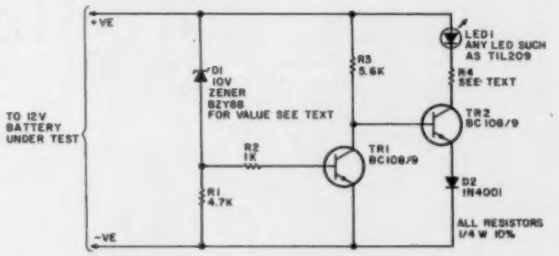
A TTL-compatible crystal oscillator. Adjust R1 for about 2 volts at the output of the first gate. Adjust C1 for best output. Thanks to Arvid Evans K7HKL.



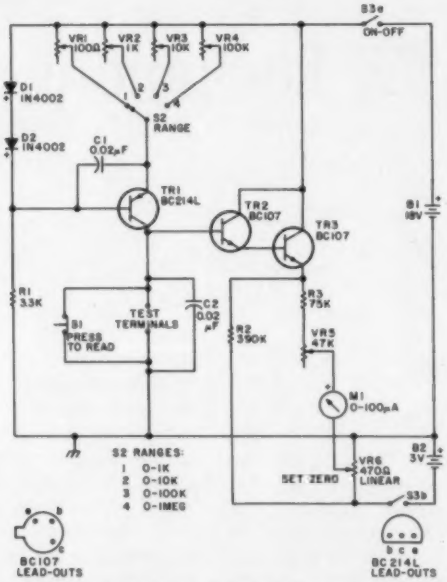
The basic noise limiter, for use with high impedance headphones. Very effective when your receiver is operating at maximum gain on a weak signal. Diodes must be germanium type. For receiver outputs of more than 15 to 80 Ohms, increase R1. If you're looking for a lower impedance load, use a 3 to 8 Ohm resistor across the input, as shown by the dotted lines. Reprinted from Practical Wireless, *England.*



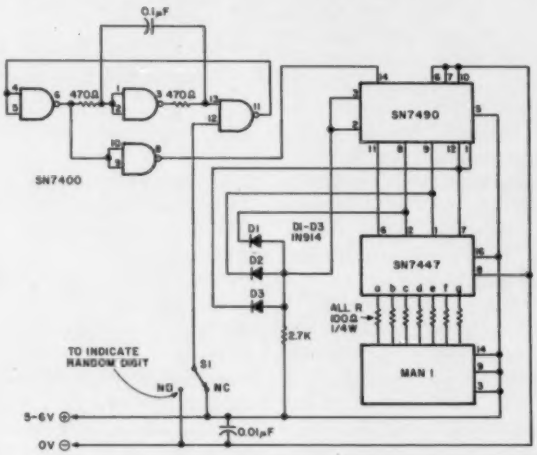
A cheap and dirty noise blanker, using tubes. FET conversion would be easy, as the circuit illustrates. Receiver oscillator line supplies 150 V, with AGC applied at V1. Circuit is especially good with FT-101 series. Reprinted from Amateur Radio, *Australia.*



Early warning circuit for battery discharge. Circuit shown is for 12 V operation, with zener D1 controlling low voltage cutoff. R4 = (voltage of zener diode)^2/LED current. Reprinted from Practical Wireless, *England.*



Linear scale ohmmeter, designed to provide accurate measurement and a linear resistance scale at the high end. The circuit has four ranges, and another meter with a current range of 10 uA to 10 mA and sensitivity of 10,000 Ohms per volt is needed for setting up. Reprinted from Radio & Electronics Constructor, *England.*



Electronic digital dice game. Thanks to D. Manoharan, Kuala Lumpur, Malaysia.

EDITORIAL BY WAYNE GREEN

from page 2

we are incredibly strong when we are able to come out ahead over a combo like that.

Some readers get bent out of shape when I enthuse over things which I find fun. I've always tried to share my enthusiasms with everyone I could, whether it be for a Porsche, FM and repeaters, RTTY (you probably won't believe how many years we had to fight the ARRL to try and get RTTY on the ham bands!), SSB, SSTV, travel, OSCAR operating, etc. I get much more enjoyment out of anything if I can share it and interest others in joining the fun. When I hear music I really like, I want to play it for everyone (it's a good thing it is illegal to play music over the ham bands!).

The Porsches are long gone, as are my plane, yacht, and Arabian horse. These days I'm lucky if I don't have to turn back a couple of items at the A&P at the checkout counter . . . one of the penalties of opting to "own" my own business instead of comfortably working for someone else. Now my employees own the planes, horses, and Porsches. That's the American way . . . right?

BUT DOES HE KNOW THE CODE?

From a clipping out of the *San Jose Tico Times* in Costa Rica (the sun never sets on the *73 Magazine* newspaper clipping input . . . with 100,000 readers watching papers all over the world for interesting items on hamming, CB, flying saucers, and who know what else?) . . . oh, yes . . . the clipping . . . it seems that Donald Nixon (nephew of guess who) got a ham ticket with the call TI2TT. He lives in Moravia.

I've gotten some interesting poop sheets (postmarked Hartford?) about retiring to Costa Rica and have been thinking of getting down there to see what is involved as a matter of interest to readers. I wouldn't be interested for myself until they improve the skiing facilities a whole lot.

Gary McClellan
Gary McClellan and Co.
P.O. Box 2085
La Habra CA 90631

Give That Professional Look to Your Home Brew Equipment

- - win prizes

Have you ever built a project and then felt disappointed with its appearance after it was done? Do you admire the beautiful projects that grace the pages of most electronics magazines? Would you be interested enough to spend a little time learning how to make your projects look better, be easier to build and service, and perhaps work better? If you answer a resounding "yes" to these questions, this article is for you! One of the problems facing electronics people who like to build their own gear is that there is more emphasis on *circuitry* than on nuts-and-bolts construction. You see this whenever you pick up a magazine and read a construction article. All too often you get a lot of "how it works" theory, a few paragraphs of "connect the green wire to point C" construction, a "how to use it" section and a schematic. That leaves a lot of open avenues for construction – great for experienced constructors, but a stumbling block for less knowledgeable people. We are going to get you started with the basics in electronic construction, and well down the road to successful project building.

The photo is a shot of the author's test bench and shows some homemade equipment. Everything you see here was built over the past two years using ordinary tools and techniques about to be discussed. Granted, large and costly projects such as an oscilloscope and frequency synthesizer are beyond the abilities of most people, but this is just to show you what can be done at home! Why not build your next project like a pro using our methods?

Good tools are the most important part of electronic project building. They save you time (your time is valuable!) and temper by making the work easier. Here is a *minimum* list of tools you should have:

Needlenose pliers
½" blade diagonal cutters
Adjustable wire strippers
25 Watt soldering iron for ICs
100 Watt soldering gun or iron for wires
1 lb 60/40 rosin core solder
Screwdriver set
Nutdriver set (especially ¼" unit)
Heavy duty jackknife (for deburring holes)
¼" hand drill or drill press
Set of drill bits
12" square/ruler

Check over your tools and be sure that all cutting edges are sharp. If you have to add tools, get good quality ones. The extra cost of good tools pays off in the long run. They stay sharper and don't break as easily. You will probably have to add tools to your present ones to handle the demands of different projects (e.g., chassis punches, etc.), but this list represents the bare minimum.

Okay, we're ready to start. We'll take each stage of the construction process step by step. To highlight the process, we are going to assemble a 5 volt, 1 Amp power supply along the way. You are welcome to build one along with us if you want. A 5 volt power supply is a great addition to any lab that works with digital ICs!

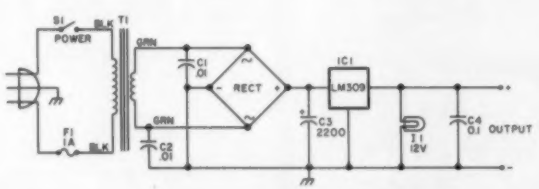


Fig. 1. A simple 5 volt, 1 Amp power supply. C1, C2 – 0.01 uF disc capacitor; C3 – 2200 uF 25 volt electrolytic capacitor; C4 – 0.1 uF capacitor; F1 – 1 Amp 3AG fuse and holder; I1 – 12 volt, 50 mA lamp and holder (Radio Shack 272-322 OK); IC1 – LM309K voltage regulator; RECT – 6 Amp, 50 piv bridge rectifier; S1 – SPST toggle switch; T1 – 12.6 volt, 1 Amp filament transformer; Misc – cabinet (LMB442 used in example), 3 wire cord and plug, binding posts, wire, etc.

Appraise the Project

The most logical way to start an electronic project is to appraise it for the best way to build it. When you find something you would like to build, you should start by looking over the circuitry and any method of construction that may be shown. If you are a newcomer to electronics, you may want to build a kit the first time out and then start building projects out of magazines and from schematics. This makes electronics a lot easier if you

start with a "paint by numbers" kit and gradually work up to more challenging projects.

Start by reading over the project (if it's out of a magazine) or by checking out the schematic. When you are reasonably familiar with it, ask yourself the following questions:

1. How am I going to assemble the electronics?
2. Am I going to build the completed project in a cabinet?
3. Are there any critical areas in the electronics that require special care, e.g., high gain amps?
4. Are there any special requirements in the mechanical construction, e.g., shielding?
5. Can I get all of the parts?

If you are building the project from a magazine article, you can answer the first four questions simply by copying the author's finished unit. The fifth question must be answered by you. If you can't get all the parts, or if they cost more than you can afford, don't build it. Instead, set the project aside, and tackle it in the future if you really have your heart set on building the item. If you are building your project from a schematic or custom building a magazine project, you'll have to answer these questions yourself and provide the solutions. Experience is the best teacher here. The schematic should give you some clues. Table 1 lists some pitfalls to watch out for.

Needless to say, the list could go on, but Table 1 is a sample. Make allowances for these things. Leave room for metal shielding, bypass capacitors, and heat sinks. Lay out parts carefully to keep input and output separate on high gain amplifiers (that includes i-f amplifiers) and leave space for heat sinks if necessary. Watch lead dress in logic circuits and VHF-UHF circuits, too. Good grounds are also very important. Keep these things in mind, along with anything else you can dig up on the project. All of the items mentioned here should influence how you build your project.

How would you like to sit down to a bench like this? This is part of the author's setup and all equipment is homemade. Shown from left to right are two stacked power supplies, a 0 to 60 MHz frequency synthesizer (signal generator), a frequency standard and digital multimeter on top, followed by a stacked function generator and counter. A triggered sweep oscilloscope is on the far right, and is topped by a digital alarm clock.

Collect the Parts

Now that you are reasonably familiar with what you are going to build, you can get the parts. There are many sources of electronic parts, of course, but you should start with your junk box. Don't have one? Start collecting old radios, TVs and other cast-off electronic devices and strip them for parts. You'll need hardware such as nuts and bolts (bought a box of screws lately?), so save all that you can get. Junk boxes are good for the basic stuff you need for a project. If yours is well equipped, you might be able to build an entire project, such as our power supply, but this is rare. For any ICs or other semiconductors and parts, you may have to turn to your local dealer, so get to know him well, if you don't already. Another parts route open to you is the surplus mail order dealer listed in the back pages of most electronics publications. If you haven't tried these dealers, you are missing out on some great bargains. But beware of reject or retested components. They can cause more problems than you would believe! Pros use quality, name brand parts – this one move often saves hours of troubleshooting later! All you have to do at this time is collect the electronic components. Leave the cabinet selection until later if you are "rolling your own" project, or buy the one called out if you are duplicating someone else's device.

Once you have all the parts, you can test them if you desire. Test any used parts that show signs of being hot; otherwise, this step is optional. Many people check all their components to save troubleshooting later, and that pays off with parts of poor quality, but this shouldn't be necessary if you use good quality parts as we recommend.

Select the Cabinet

Now that you have all the electronic components together, the time has come to select a cabinet to house your project, and perhaps a chassis as well. The secret of success in selecting the right housing for your equipment is *advance planning*. The idea is to were assembling the unit into a cabinet. Allow at least 1" clearance around the circuit board (if used) and any adjacent parts. Separate heat producing parts such as transformers, power resistors, and power transistors at least 2" from any other parts. The back cover is a good place for resistors and transistors, while the transformer may be mounted toward the rear. This is just a "first fitting," so you don't have to place the get a cabinet that is large enough to house all of the parts of your project, plus allow room for easy servicing and future modification. You do not want the cabinet to be too large; this is an unnecessary expense, and oversize cabinets mean excessive bulk. Here's how to select the box or chassis that is right for you with a minimum of fuss.

The first step is to visit your dealer and find out what cabinets and chassis are available to you. You might also want to write the manufacturers listed at the end of this article for catalogs – this will help in your selection. Next, lay out the parts that normally mount inside the cabinet on a table. This normally includes circuit boards, large caps and transformers. Lay out the parts like you

Pitfall	Solution
High gain amplifier or tuned amplifiers	Extra shielding may be required.
High gain amplifier or tuned amplifiers	Inputs and outputs well separated.
High gain amplifier or tuned amplifiers	Power supplies remoted or shielded.
AF or RF oscillators	Good shielding and bypassing of power leads.
AF or RF oscillators	Sturdy mounting of coils and capacitors.
Digital logic ICs	All power supply leads must be kept short and well bypassed with capacitors.
VHF-UHF circuits	All leads must be kept short.
Power supplies or power handling circuits	Good heat sinks for all power devices.
Power supplies or power handling circuits	Heavy wire where necessary to minimize losses in power.

parts exactly. Measure the height, width, and depth of the layout and you have the *minimum* case dimensions. Consider what components you have to add to the front and rear panels. If they would interfere with the parts layout you made, add more space to the *minimum* dimensions. Meters and speakers are great space hogs in this respect! Continue to add parts to the front and rear panels, making corrections to your minimum dimensions as necessary. Be conservative in your estimates. A little extra room in the layout makes construction and servicing much easier. Also, you may suddenly discover the space for shielding, as in the case of a radio receiver project. Consider using chassis in your more complex projects. You can mount your PC boards on top, over a suitable sized cutout, and this will make construction and servicing a snap. Chassis are also used as shielding boxes – this may be necessary in a project where many sensitive circuits must be placed in the same case. Our frequency synthesizer is a project in point: It uses 6 fully enclosed chassis boxes to isolate the many VHF frequencies the circuits generate from each other.

Finish up your case or chassis selection by taking your dimensions and selecting a box to fit. Since you will probably have some oddball dimensions, you may have to look for a larger box or an odd sized one. With practice, selecting a case can be done quickly, with just a few measurements and the catalogs.

Build the Electronics

This is the largest step you'll probably have to make, but we are going to simplify things a bit. Because of space limitations, we can't fully discuss the wiring phase of a project. Instead, let's look at the highlights of electronic construction.

To start with, there are three basic ways to assemble an electronic circuit. You can use a PC board, a perfboard, or mount all the components on the project's cabinet. Often two of these techniques are combined, as it is common to mount small components such as caps, resistors, or transistors on a PC/perfboard and then mount large components such as transformers and speakers on the cabinet. So which construction method is best for you? The choice is fairly easy – if a PC board is available, or if you feel you can make one, use it. PC boards are also recommended for complex digital circuits (about 10 chips or more) and critical circuitry such as high gain amplifiers. Perfboard construction is a handy method of construction for simpler, less critical circuits. Construction may be a little harder than a PC board because you have to figure out the placement of each part as you wire it up. On a PC board, the designer has determined layout for you and assembling a PC board (nicknamed "stuffing") is often like building a kit – easy! Another method of construction is assembling all the parts on the project's cabinet and wiring them up. This method works fine when there are few parts and most of them are made for chassis mounting. Small parts are often mounted on terminal strips to keep them from touching the chassis. You will often see this method used in power supplies (such as ours) and other simple projects.

Laying out your circuitry isn't necessarily difficult if you don't try to rush construction. Just take your time and use some intelligent planning and the results should be good. If you are using a commercial PC board, you can skip this part; just stick the parts in as per the pictorials and solder them! But if you are working with perfboard, or *laying out a PC board,* follow our hints to ease your job.

The schematic, and any other circuit information available, has the most powerful influence on how a circuit should be built. For example, if pictures or drawings are available, you might get by building your circuit from these. Or, at the very least, these illustrations can give you ideas on how to lay out the circuit to suit your own needs. So it goes without saying that you should read over any texts and illustrations available on your project before starting! There just might be enough information available to skip this section! Also you want to look for "problem areas," parts of a circuit that are sensitive to component layout. Examples of this area: grounds in HF to VHF circuitry, power supply bypassing around digital or linear ICs, component lead lengths, and so on. A good author will point these things out and probably more, so when a suggestion is made to handle these problems, take heed! *Caution:* If you see many problem areas in a project and you aren't sure you can handle them all, get a PC board if available, or drop the project. This can save you grief!

But suppose you are building a project from just a schematic. Now you have a challenge! But here's the basic way to go about building the circuitry: First, select a board large enough to hold all of the parts, then refer to the schematic. You can often lay out the parts on the board just like the schematic – you might consider this. This makes complicated circuits easier to trace, but a well-drawn schematic is required. Otherwise, try this: Stick the major parts (e.g., transistors, ICs, etc.) on the board. Then stick in the smaller components around the pins of the IC or transistors they would connect to. Try to position the parts for shortest lead length. And remember how you appraised the circuit to begin with? Try to account for any pitfalls you found at that time. You may do this technique for just one stage at a time, as in complicated circuits, or do an entire circuit at once! Some tips to use in your layout and construction: Leave plenty of room for all parts, avoid "layered" construction, or the placement of, say, resistors on top of capacitors, and always use sockets on ICs. When you have a layout that satisfies you, wire up the parts. Use #18 to #24 bare tinned copper wire for all grounds and power supply leads if possible. When you are done, check your work and plug in any ICs. You might be able to check out the board to see if it works, too.

Tackling the Cabinet

Now you get to lay out, machine, and label the cabi-

net. And in the bargain you'll get some exercise! Start by laying out the cabinet. You should have a general idea of what goes where in the cabinet from the section on its selection. Now improve on that by collecting the parts that would mount on the front panel. Oh yes, don't forget the box you selected! Play "chess" with the parts by placing them on the outside of the box and moving them around until you get an arrangement that looks aesthetically pleasing. Some tips to aid you: Lay out controls in a symmetrical manner – that means in a straight line (if you have many controls, stagger them). Balance them so they are neatly centered between the ends of the box. If possible, group the controls by function. Mark all hole locations. Masking tape works well here. Then follow the same procedure for the bottom and back of the box. Be sure that there is still room for all of the parts. If you need ideas for your cabinet layout, why not check out some commercial gear? This can be very helpful if you are stuck.

Once you have the locations marked, you can start drilling them. A center punch is recommended to punch all hole locations for greater accuracy, but this is an option. When you have all cabinet holes drilled, use the knife to deburr them. Then tackle special holes, such as square ones for displays or round ones for meters. You can cut these either by drilling holes around the inside edge of the cutout, punching out the slug and filing to size, or by using a chassis punch. A sabre saw could also be used, but it would mark up a painted panel. The choice is up to you! After you are done, deburr any leftover holes and wash the box. Use detergent and water if the box is painted, or a scouring pad and detergent if it is bare aluminum. Finish up by drying the box thoroughly.

You might want to paint the box. For best results, warm up the box to about 30 to 40° C. Then use your favorite color of aerosol spray to do the job. Follow the instructions on the can and you should get good results. (Incidentally, it is often cheaper for you to buy an unpainted box and paint it yourself!) Let the box dry in a warm dust-free place overnight. Then, take it and apply a light coat of clear acrylic spray; this will make application of the labels easier. Let it dry several hours.

Now you can apply decal labels to the cabinet. If you don't have any, you should be able to get them from the larger electronics distributors or perhaps by mail order. You can also get alphabet sets from most drafting suppliers for low cost. Typical names for decals are Letraset® or Technilabels®, and they come in sets for experimenter, ham, etc. Common words are already spelled out for you and they are very easy to use. The drafting alphabet sets have names such as Paratipe® and Zapatone® and have only letters – you must make up the words yourself. Applying these labels to the cabinet is easy – they just rub on with a blunt pencil. If you get a word or letter in the wrong place, it easily comes off by placing a piece of cello tape over it, rubbing it, and pulling it off. Be sure that you allow plenty of clearance for the knobs when you apply the labels. After you label the front you may wish to label the rear, too. This will complete the professional appearance of your equipment! Spray the outside of the cabinet with clear acrylic spray when it is labeled to your satisfaction and let the box dry.

Final Assembly

I can imagine that you are getting pretty excited by now, because you are in the homestretch! Now you get to connect up a lot of loose parts and see if the project really works.

Complete the final assembly by mounting all the parts on the front panel. Install the knobs (did you get good-looking ones?) when you finish. If you did everything well so far, the project should go together like a kit – fast and easy! This is something to shoot for. Continue with the rear panel, too. Then mount the circuit board in the bottom of the box (if a board was used) with ½" or longer metal spacers. Use at least 4. Mount any other parts as necessary, and the mechanical construction is done.

Complete the wiring and you are home free. Refer to the schematic for details. I should warn you that it may be necessary to loosen or disassemble parts to wire them, so you might want to keep this in mind. Despite the best plans of mice and men, this problem crops up from time to time, so keep a screwdriver handy! Note the power supply.

Checkout

The moment of truth has come! You plug it in and there is a very good chance your project will show signs of life. Our power supply sure did! If so, congratulations on a good job! If not, you'll find a carefully built project much easier to troubleshoot than a haywire rig with a maze of carelessly laid out wires and components. You really gain with a properly built project; it is more likely to work, it is easier to service, and it looks a heck of a lot better to boot! Isn't it about time you got on the bandwagon?■

Some Cabinet Manufacturers

Bud Radio, Willoughby, Ohio
California Chassis Co., 10636 Midway Avenue, Cerritos, Ca. 90701
LMB Company, 725 Ceres Ave., Los Angeles, Ca. 90021
Ten-Tec, Inc., Highway 411 East, Sevierville, Tenn. 37862.

Note: **This list is by no means complete. Check with your dealer for others.**

Looking West

from page 25

autopatch to fail due to user abuse. Since that time, ACK has taken a few steps in its evolution, including a frequency change to make way for the Baja repeater. Now, with the formation of the Marina Repeater Association to sponsor it, it has come up with a new objective as well.

While the prime objective is to provide the aforementioned type of communication, I foresee another important aspect to both ACK and MRA, that of being in the right place at the right time should an emergency on water manifest itself. By its very nature, the organization will be composed of amateurs who are adept at the many aspects of seamanship and will have a goodly number of vessels as part of its flotilla. Should an emergency requiring instant communication manifest itself, this group will be in a position to provide it, as well as handle other aspects of such situations. Again, it's skilled amateur operators adding another direction to amateur relay communication – another repeater with a purpose.

Now, as if all that were not enough, there is still one more important aspect to MRA, according to organization President Al Ezor W6QQG and its Vice President Bill Hawley W6ZRZ. MRA also intends to publicize amateur radio as a communications agent augmenting the pleasure of boating through various boating magazines and thereby interesting would-be amateurs in taking that all important first step. In the LA area, it plans to operate and sponsor the necessary classes to provide this training, which could result in a goodly number of new combination amateur radio/pleasure boating enthusiasts.

So, if you are planning to sail the Pacific coast between Oceanside and Ventura, keep an ear on .205 for the ID that reads WR6ACK. It may have been there for a long time, but now that ID holds a whole new meaning. For more information about this project, contact the Marina Repeater Association, PO Box 9894, Marina Del Rey, California 90291.

A few months back, *73* published a letter to the editor from a Northern California FMer directed toward us about the night to day differences between FM up North and that which we practice down here in the Southland. Is there that much of a difference between North and South? What is FM relay operation like in the Bay Area? Next month, Looking West takes a drive to San Francisco to tell you first hand all about it. See you then.

You Already Have an Atomic Frequency Standard

-- here's how to use it

B.F. Jacoby WD8ASL
88 W. Frankfort
Columbus OH 43206

Whenever a frequency standard is brought up, usually the discussion turns to the National Bureau of Standards' shortwave broadcasts on station WWV, but using these transmissions at any distance from Fort Collins, Colorado, where the transmitter is located, is difficult when reception is poor.

If you service CB radio equipment, commercial transmitters or amateur radio gear, an accurate means of measuring frequency is essential. If you are an experimenter or radio amateur who has a frequency counter, perhaps you have either not calibrated it or let its calibration slip because you did not realize that an atomic frequency standard was as close as your color television receiver.

For some time now, NBS has been pushing the color TV burst frequency as a method of frequency dissemination, and once you use the system it will become apparent that it is both very accurate and inexpensive to implement.

The basic idea is that all three major TV networks use atomic oscillators to produce the 3.57954545454 MHz color subcarrier frequency which is used to code and decode the color information in the video signal. This subcarrier frequency, or more exactly a piece of it, is broadcast with the video which is then used by the color receiver to regenerate a continuous carrier in the set for decoding purposes. The continuous frequency generated by the set is locked in frequency and phase to the transmitted piece of carrier or "color burst" as it is called, which thus produces an exact replica of the output of the network's atomic oscillator. While there may be minor phase shifts due to path length changes from network switching, the frequency stability is basically that of the generating source.

Thus, your access to an atomic frequency standard involves two simple steps:

1. Bringing the color burst frequency out of a TV and into your counter.
2. Waiting for a network program to come on. (Local stations use crystal oscillators which, while good, can be a couple of Hertz off frequency.)

The tapping of the color burst frequency in your set may take a little imagination, since each set is a little different. Receiver subcarrier regeneration systems fall into two broad categories: phase locked oscillators and ringing tuned circuits. To get into the right territory, look for the color burst crystal on your set's schematic diagram. Examine the circuit around the crystal to determine which type of system you have. If the crystal is an oscillator, then you have the phase locked type and it is the *output* of that oscillator

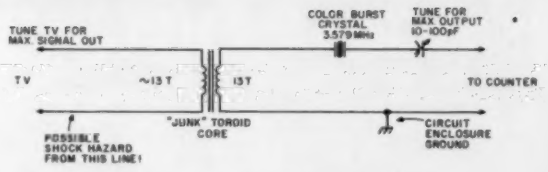


Fig. 1. Color burst isolator and filter.

that you want to bring out of the set. If the signal seems to pass through the crystal as a filter, then you have the "ringing" system and it is the output of the amplifier stage following the crystal that you should tap. Do not try to take an output from the crystal itself, as this can lower its Q and could stop oscillations altogether.

In either case, look for a good low impedance output point. Careful probing about with a scope should turn up a nice clean waveform you can use. Some set schematics have waveform pictures that can often be helpful clues. A word of caution is needed to remind you that many portable receivers have no power transformer, so the chassis could be 115 volts *hot!*

For this reason I have used the circuit of Fig. 1 on my portable set. The toroid transformer isolates the set from the line, and I have included an additional color burst crystal to peak the waveform into nice clean sine wave and filter noise pulses. This circuit easily drives my counter, which is not particularly sensitive. You may find that the "tint," "color" or "fine tuning" controls on the set, as well as the trimmer on the isolator circuit, may need to be used to peak your output waveform.

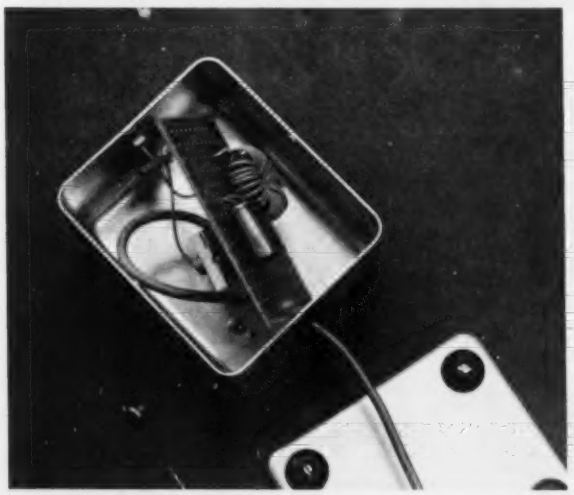
I've found that the tap-off circuitry tends to affect color reception, so you may want to have a jack to remove your output circuit when you are not using the set for calibration purposes. An alternative is to only use the set as a frequency standard. This may sound expensive, but my little set was free! It lost one of its colors in the picture tube and was deemed not worth fixing by the owner. This is a very common occurrence. Since you really need only one color to tell if a program is network (you could probably get by with just sound), so long as the color burst section is working, you have your atomic standard.

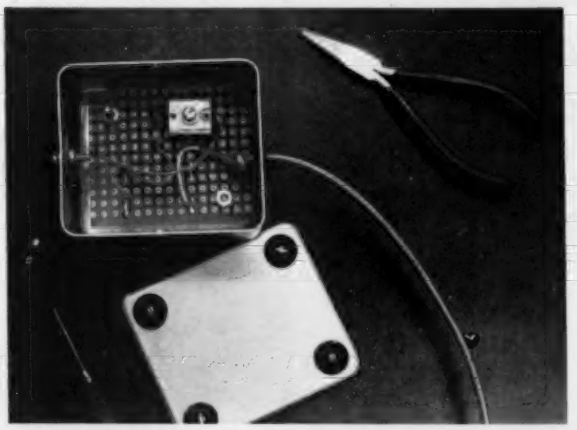
My home-built counter has a timebase that can be set as long as 100 seconds, which means that the counter, when adjusted, can read color burst frequencies to .01 Hz (or has an accuracy of .1 Hz at CB frequencies or .4 Hz at 2 meters). If your counter reads with a 1 second timebase, you can only set it to 1 Hz at color burst frequencies, giving you an accuracy of 10 Hz at CB and 40 Hz at 2 meters when calibrated.[1]

To calibrate the timebase oscillator on your counter, just feed the color burst frequency from the set into your counter and read its frequency with your maximum resolution setting. Now adjust your timebase oscillator trimmer until the display reads 3,579,545.35 Hz. The reason for the .35 Hz rather than the "ideal" .45 Hz is that all network frequencies are slightly offset due to a change in the international frequency standard after the oscillators were installed. You should measure with a good clear stretch of network programming and look out for commercials that may be local. Greatest timebase accuracy is attained when your counter is left on continuously, and in any event you should remember to allow a good warm-up period before calibration.

While the network frequencies have been 3,579,545.35 Hz for years, if you really want to stay on top of this situation you can subscribe to the NBS monthly time and frequency services bulletin, which lists the exact offsets for each network on a weekly basis. It is free on request, the only

[1] Notice that if you use the 15,734 Hz sweep frequency rather than the 3.579 MHz color burst to set your timebase, an error of reading ±1 Hz translates to an error of ±9000 Hz for 2m.





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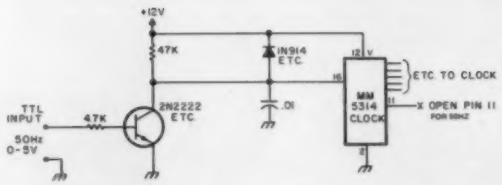

Fig. 2. Driving clock chip from timebase TTL output.

"cost" being a questionnaire they ask you to fill out about once a year asking which NBS service you use (WWV, TV data, etc.), how often, and why (ham radio, CB service, hobby, etc.). With the bulletin, great accuracy can easily be achieved. Those of us with clock and frequency standard hobbies have found the TV system to be a tremendous boon to obtaining synchronization of our secondary standards with little effort or expense. For extreme precision, a beat-frequency method can be used (but it is more complicated than the direct count method described here).

If you choose to leave your counter running continuously, you may wish to consider dividing your timebase to 50 Hz and building one of the numerous clock kits available today. Set your digital clock chip to run from 50 Hz, and feed the timebase signal into the circuit where it previously was connected to the power transformer. (The 60 Hz line is still used for power.) The simple interface circuit of Fig. 2 is an example that has worked quite well with the popular MM5314 clock chip.

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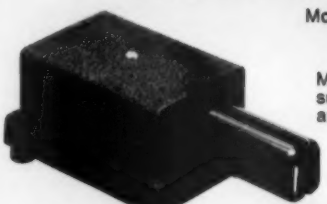

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Give the Hamburglar Heart Failure

- - car alarm system

With the theft rate of ham rigs on the rise, an alarm system should be installed by anyone who wants to protect his car and rig. Although an alarm system won't keep thieves from breaking into your car, it does make it much more difficult to do so unnoticed. After looking at the many, many alarms on the market, and their terrific prices, I decided that there must be a better and cheaper way. Many articles have pointed out the need for a "different" sounding alarm such as a bell, siren or similar device. But, for the money, the automobile horn is still hard to beat. After all, every car has one.

CMOS integrated circuits are a natural choice for use in automobile intrusion alarm systems due to their extremely low power dissipation. A sophisticated alarm circuit has been designed around two CMOS packages incorporating multiple time delays. The alarm circuit is armed by a hidden switch located inside the car. This design uses delay times to advantage. There is a delay from the time the operator turns on the alarm to when it actually is armed. There is also a delay from the time the intruder opens the door to when the alarm is actually sounded (this allows the operator to disable the alarm). In addition, there is a fixed time when the alarm is actually sounded, thus not running down the car battery more than is necessary. When the alarm is finished sounding, the circuit automatically resets itself, ready for another intrusion. In order to use the car horn as an alarm device, I decided to pulse it at a rate of 60 times per minute. This way people will not confuse it with a stuck horn. The circuit can either drive a relay, which in turn drives the horn relay, or it can drive a power transistor. The method depends on how much current the horn relay draws. The door switches are used as intruder sensing switches; other switches may be added on the hood or the trunk as considered necessary. All of the time delays are adjustable by changing several resistor values.

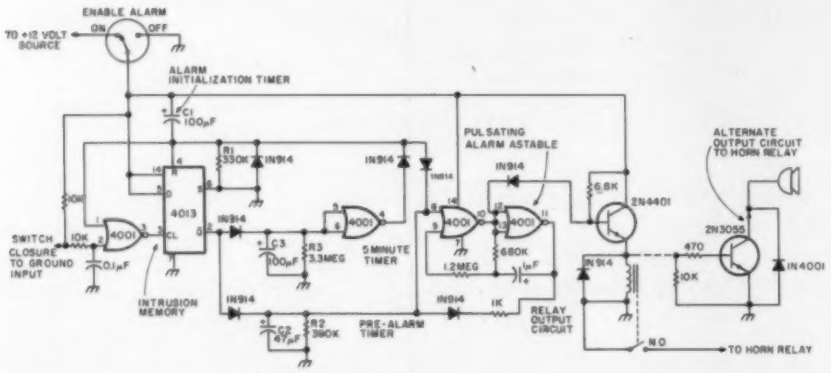

Fig. 1. This CMOS alarm circuit uses only two integrated circuits, yet provides a high degree of flexibility in its use. Delay times are provided to aid in the arming and disarming of the alarm. Once the pulsating alarm is sounded, it resets itself automatically after several minutes. $C_1 = 2C_2$; R_1C_1 – initialization reset timer (30 sec); R_2C_2 – pre-alarm timer (15 sec); R_3C_3 – alarm sounding timer (300 sec); ground 8, 9, 10, 11 on 4013.

Fig. 1 shows the schematic of the alarm using a quad NOR gate and a D flip-flop. The input to the alarm is taken from the door switches which control the dome light. When the doors are opened, these switches short to ground. The input signal to the alarm is normally 12 volts and goes to ground when the doors are opened. The driver enables the alarm by a hidden SPDT switch which connects 12 volts to the circuitry. Resistor-capacitor combination R_1C_1 develops a reset command signal to the intrusion memory when the alarm is enabled. This time delay permits the driver and passengers to exit the automobile prior to the arming of the flip-flop. Once the reset time delay expires, the flip-flop is ready to detect a switch closure to ground at the input. Once a closure to ground occurs, a positive going signal clocks the "D" flip-flop. Capacitors C_2 and C_3 were initially charged to 12 volts during the reset interval and they begin to discharge. R_2C_2 discharges below the NOR gate input threshold first, causing the 1 Hz astable oscillator to turn on. This astable oscillator is used to drive a small relay or transistor which turns on and off the horn relay in the car. R_3C_3 discharges below the NOR gate input at a much later time, generating a reset command to the intrusion memory. Thus, the complete process can repeat itself if another intrusion is detected.

The complete circuit can be built on a small vectorboard. IC sockets should be used for the CMOS circuits or a grounded tip soldering iron

should be used if soldered. Layout is not critical at all. For those who wish to duplicate the prototype, a 2" x 4" printed circuit board is being made available.[1] The circuit board can be mounted under the dash or under the seat. In one installation, the board was mounted in the trunk. The on-off switch for the alarm should be hidden, but within easy reach from the driver's seat. I would say where mine was hidden, but then it wouldn't be hidden anymore! Most horns use a horn relay located either near the fuse box or near the horn. The relay normally requires a switch closure to ground to sound the horn. If this is the case, then the transistor or relay output from the PC card can be used to connect to the horn relay. Since only four wires are needed to connect this alarm circuit, installation is very easy.

When the driver enters the car, the alarm is turned off, but will be initialized instantly if turned on again. In practice, a time delay of 30 seconds was chosen for the R_1C_1 time constant. R_2C_2 was chosen to be 15 seconds and R_3C_3 is 300 seconds. Either a relay or NPN transistor may be used to trigger the horn relay in the car, depending on how much current must be controlled. Since only two CMOS ICs are used, the circuits will easily fit on a small circuit board and mount under the dash. If the trunk or hood switch is paralleled with door switches, then it too will trip the alarm.

It is comforting to know that your car is being protected against intrusion. Since the alarm is controlled from the inside of the car, it is much more secure from intrusion. ■

[1] A 2" x 4" single-sided printed circuit board is available from I/O Engineering, 9503 Gambel's Quail, Austin TX 78758. Drilled $4.75; undrilled $3.75. Postpaid USA.

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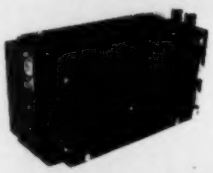

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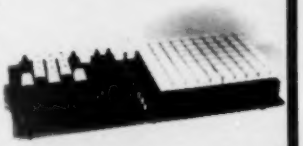

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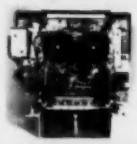

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Contest Special Keyer

- - has short but adequate memory

Due to requests for the circuit of my keyer, displayed at the club home brew night, I decided to present the circuit, as well as a technical description, for those who might want to add it to their own setups.

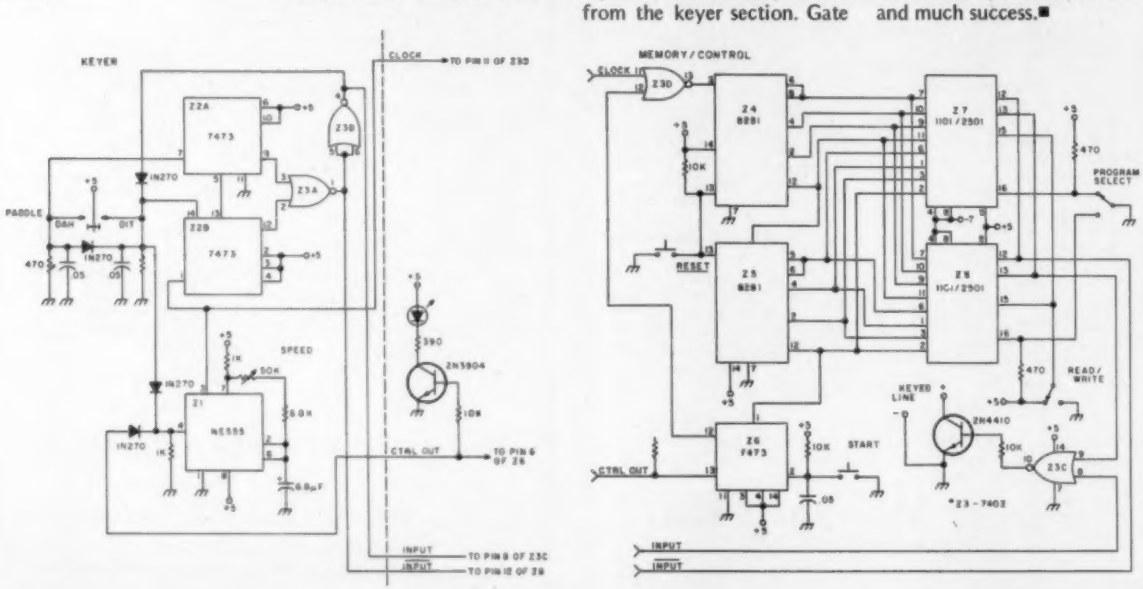
The keyer portion is of straightforward TTL design. The clock, Z1, is an NE555 timer because of its stability, low cost, speed range and ease of operation. My keyer ranged from 5 to 35 wpm. Flip flops Z2a and Z2b form a counter in which the clock pulses are counted to provide dits and dahs with spaces. Z3a combines the outputs of the flip flops and Z3b inverts this. The diodes connected to the paddles provide self-completing dits and dahs.

Now the memory/control section. ICs Z4 and Z5 are two 4 bit binary counters which act as the "addressing" for the memory, composed of Z7 and Z8. Flip flop Z6 is the memory control. The clock from the keyer is gated with the control flip flop at Z3d to form the clock for Z4. This automatically stops the memory from writing over data just read in from the keyer. The LED gives a visual indication of the state of the control flip flop, telling you that the thing is through. The input to the memory comes from the keyer section. Gate Z3c combines the outputs from the keyer and the memory, allowing you to store and send over the air at the same time. The output of that gate keys a high voltage transistor, which should key any grid-blocked keyed rig. The control output is used to turn the clock on and off in the keyer.

Here's some information on the memory ICs used in the keyer. The 1101 is a static 256 x 1 bit random access memory (RAM). A dit takes 2 bits (dit-space), a dah takes 4 bits, and a space takes 3 bits. The total number of bits you can store is 255. To program this keyer, all you have to do is choose and switch the memory into *write* mode. Hit the *start* button and send the message on the keyer paddles. To send it back, change the mode switch and hit the *start* button. *Reset* will clear the address counter so you can start over if you goof. The address counter counts clock pulses and increments on the negative edges of them. Changing the message takes as long as it takes you to resend it.

This keyer works great, and I use it to send all my CQs and to ID the station when on RTTY. To those who build it, I wish you luck and much success.■

Reprinted from *The Link*, Bulletin of the Buffalo Amateur Radio Repeater Association, Inc., May, 1975.



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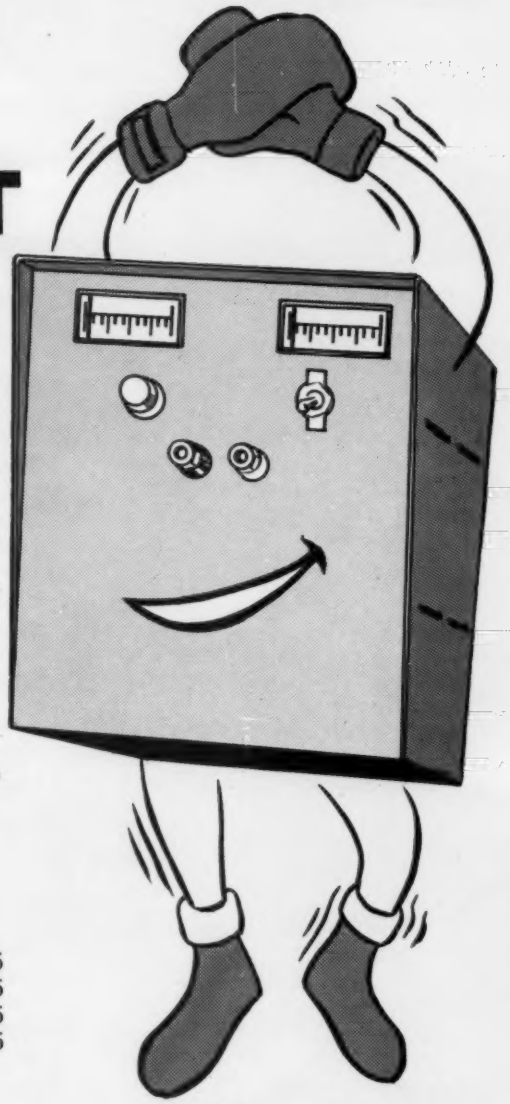

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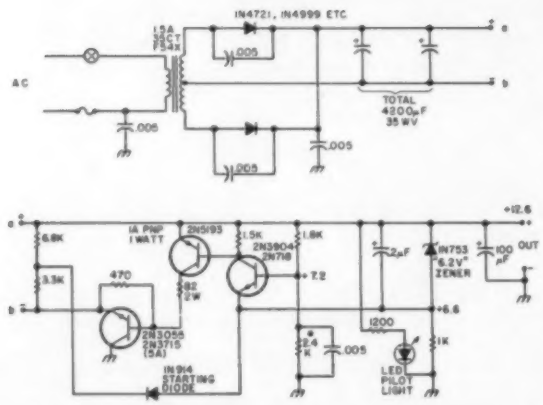

*Fig. 1. 3 A regulated supply (12.6 V). (a) Rectifier. (b) Regulator. The capacitor on the output is a tantalum slug type, of any value over 10 uF. The 3 A unit will carry a typical 10 or 15 Watt 2m transceiver. The 82 Ohm resistor constitutes the short circuit protection. *Adjust to set output voltage.*

This *is* a "how-to-build-it" article, but it also includes some hints in the "how-to-select-parts" area.

The problem with most "how-to" articles is that nobody ever has exactly the right parts. That's what keeps the kit business going. However, assuming that you do have some parts, how do you find out if they are appropriate? If you can find a suitable transformer (mine is sufficient for the cycles you may encounter outside the U.S.) and enough filter capacitance, the rest is sort of flexible.

I built my FM power supply inside a 4" x 8" x 2" aluminum chassis. Getting the transformer into the 2" dimension was a tight squeeze; 2½" would have been better, and 5" x 10" x 3" would have been spacious. The cord, switch, LED pilot light, output socket, fuse-holder and the T0-3 power transistor went on one 2" x 4" end, leaving five faces blank. Inside, after finding room for two surplus electrolytic capacitors and the transformer, I wired the circuit on a couple of Cinch-Jones 2012 terminal strips. No sweat; no PC board. Save that jazz for complicated circuits!

Using a bigger transformer or more (thousands of) microfarads could only improve things. The power transistor was bolted directly to ground and the aluminum box provided adequate cooling. If you use a steel chassis, however, you may need some sort of heat sink, but remember that a silicon transistor will work all right even when its case is uncomfortably hot.

Fig. 1 shows the schematic of the 12 V supply. The transformer is nominally 35 V at 1.5 Amps, center-tapped. It weighs about one kilogram. An 18 V, 2.5 Amp unit of about the same weight and size, used with a bridge rectifier, would probably be satisfactory. I wouldn't try to use a 12 V transformer, as there isn't enough reserve for low line voltage. Instructions on checking out the alternative transformer you have on hand are given later in this article.

With the F-54X at a line voltage of only 100 V, the supply put out 3 Amps before losing regulation; at 105 line volts, 4 Amps; at 110 V and up, 5 Amps. For continuous service, two Amps is probably the limit, but since FM transceivers spend most of the time on receive, the low current works OK. The above figures are for 12.6 V out. For higher outputs, the transmit power will increase, but the current capability at any particular

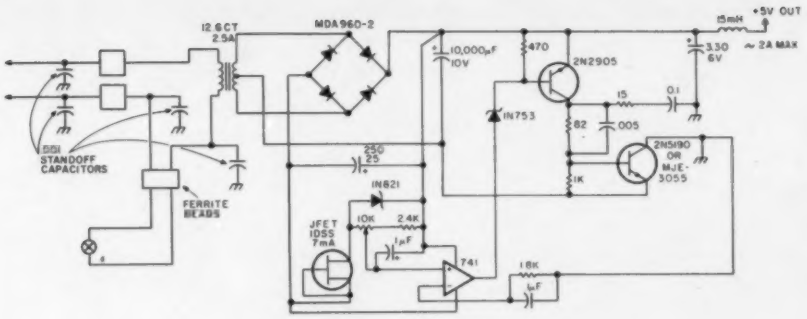

Fig. 2.

primary voltage will be less.

Each diode specified is rated for 300 Amps surge, 3 Amps average and will stand a short circuit long enough for the primary fuse to blow. No heat sinking is needed.

The filter capacitors may see more than 30 V, so you need capacitors rated at either 35 working volts or 25 working volts/40 V surge rated. They should have at least 2000 uF per Amp of rated load (more is better).

The pass transistor I used was a 2N3715 (similar to a 2N3055). The plastic MJE 3055 (or any one of the many TO-3 size silicon NPN power transistors) should be satisfactory.

Although the regulator circuit is simple, it continues working down to less than a volt between input and output — this is unusual. To keep the voltage drop down, the pass transistor is driven from the regulated output voltage, but this means that a separate starting circuit (two resistors and a diode of no particular type) is needed to turn things on initially. Once the starting diode has disconnected (during operation, its cathode is more positive than its anode), the regulator is unaffected by the magnitude of the unregulated input voltage — which is why it wouldn't start without the extra circuit.

Multistage regulators may oscillate. Stabilize this one by putting 10 uF or more (tantalum type preferred) on the output. I used a CS13AE 101K (100 uF, 20 V), because I had a lot of them.

The PNP driver could probably be a 2N2905, but the 1 Amp plastic power transistor (2N4918) I used is harder to blow out and has good gain down to 1 mA. I mounted it inside the chassis with a 4-40 metal screw using the mica washer provided. The 82 Ohm, 2 Watt resistor protects both the transistor and the power supply in the event of a short on the output. If you use higher resistances, you'll get a lower maximum base drive to the pass transistor and less short circuit current.

Depending on the actual voltage of your reference (zener) diode, you may have to adjust the voltage divider in the base of the NPN amplifier. I prefer setting things up with a soldering iron and putting a high resistance across one or the other divider resistor. In this case, I used a 24k Ohm across the 2.7k Ohm, because the 1N753 had only 5.9 V drop at 6 mA. If you put a 1000 Ohm pot between the two resistors, with the 2N3904 base hooked to the arm of the pot, it will still work. The capacitor still goes from base to ground.

Connect a capacitor across the reference diode. I've tried everything from 1 to 40 uF, so the size is not critical.

Place ceramic disc bypasses across the diodes (right across — with very short leads) to reduce hash picked up on AM broadcast sets. A number of commercial supplies, as well as automotive alternator diodes, can cause this sort of interference.

In wiring high current supplies, it is good practice to run wires from diodes and the power transformer directly to the big filter capacitors and then run additional wires from the capacitors to the regulator. Run the input leads together to keep the stray field down — those wires are carrying 10 Amp pulses. In a ham station, it is also smart to filter all leads for rf; audio rectification in a transmitter power supply can give some strange feedback.

A design-it-yourself program is as follows:

a. Measure the output voltage. In this case, given 12.6 V, I added 1 V for regulator variations and 15% for power line variation, for a total of 15.6 V minimum instantaneous (dc minus ripple) input to the regulator at 115 V.

b. Measure the load current and calculate ripple. For 2 Amps, given 4200 uF (that was what I had), peak-to-peak voltage = 2 x 1/120 x 1,000,000/4299 = 3.97. On that basis, required dc is 17.6 V and rectifier load R is 8.8 Ohms.

c. Using a VOM, check the power transformer for the following values: line voltage = 115 V; secondary, no-load voltage = 39 V (10% higher than nominal); ratio of primary to half secondary = 5.9; dc resistance of primary = 9 Ohms. Primary resistance reflected into half secondary is then 9 divided by $(5.9)^2$ = 0.26 Ohm. Measured secondary resistance = 1.1 Ohm; half of that = 0.55 Ohm. Thus the series resistance of the transformer is effectively R_S = 0.55 + 0.26 = 0.81 Ohm. At 20 Amps instantaneous, the diodes I picked have a 1.2 V drop with a slope equal to 0.01 Ohm at that point for a total of 0.82 Ohm.

Referring to the curves,* I put in the ratio R_S/R = 0.81/8.8 = 0.093 and C x R x 2π f = 13 with a result of 20.9 V. From this, I deducted the 1.2 V dropped in the diodes to get 19.7 V dc. Since I needed 17.6 V, this worked, leaving an extra ten percent to take care of transformer heating (the resistance increases when the windings get hot) and nonsinusoidal power line waveforms.

In applications where noise and ripple requirements are moderate, a grounded collector pass transistor is often convenient. Fig. 2 shows the 5 V supply I built for a receiver frequency counter that used LED readouts. The display added a strobed 1 Amp load to the other drain, putting the requirements out of reach of the usual IC units. The circuit, as shown, fit the parts I had on hand and performed well enough down to below 90 V from the power line. I used a compensated reference diode, but a 1N753 will do as well. The FET current regulator (if you have one with I_{DSS} around 7.5 mA) is an improvement over a 1200 Ohm resistor, and of course a 741 is one of the best op amps you can buy for forty cents. The driver and pass transistor are treated like the equivalent parts of the 12 V regulator. (Refer to previous discussion.) The power transformer was a Triad F-26X, 12.6 CT at 2.5 Amps. The 10,000 uF filter is no bigger than necessary. ■

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*Originally from O. H. Schade, *PIRE*, July, 1943, but can also be found in the *Radiotron Designer's Handbook* and, with some modification, on p. 108 of the 1976 *Radio Amateur's Handbook*.

73 Magazine *Staff*

You Can Sound Better with Speech Pre-emphasis

- - a simple circuit which will work wonders

This article describes a very useful single transistor stage peaking filter together with a low noise, rf protected preamplifier stage. One of the main features of the circuit is that the overall gain of the filter stage remains essentially constant except at the frequency which is to be peaked. The peaked frequency can be continuously increased in gain up to about 20 dB as compared to the overall frequency response (about 200 to 4000 Hz).

The main application of this filter is to improve speech intelligibility for any mode of modulation, particularly for those of us who tend to be rather bass-heavy. Simple high pass filters can, of course, remove bass frequencies, but that is all they can do. A peaking filter, on the other hand, can be used to emphasize the so-called "presence" effect as hi-fi enthusiasts know it. This means a soft peak in the overall frequency response of a system around 1500-2000 Hz, which adds a great deal to the improvement of speech intelligibility. By choosing a good communications type microphone which normally attenuates frequencies below 300 Hz, and with the aid of a peaking filter, most base-heavy amateurs can achieve a good, solid, communications speech response without sounding unnatural or distorted. The variable gain feature of the filter at the peaking frequency allows one to adjust the filter to suit individual voice characteristics.

A secondary use of the peaking filter circuit in receiver application is as an audio-type CW or SSB filter. Admittedly, there are sharper, single frequency IC designs available for such filters using also only RC components, but the filter design to be shown can be made both variable in frequency (over a narrow range) and variable in peaking amplitude. Thus, by connecting in series two such filter stages which tune 500-1500 Hz, one can peak a single audio frequency with both stages with sharper selectivity, or any one of two audio frequencies independently with variable gain, depending upon how QRM conditions vary.

The circuit of the combined preamplifier and filter stage is shown in Fig. 1. The microphone preamplifier is especially suited for low to medium impedance dynamic microphones, but it will work well with almost any impedance microphone. The ferrite beads, a low Q 1 mF electrolytic coupling capacitor, the 10k resistor and the 200 pF base to emitter bypass in the input stage all are designed to keep rf out. Assuming the preamplifier and filter stage are mounted in a separate shielded enclosure, no rf problems should be encountered. The 200 pF base to emitter bypass is a nominal value. For 2 meter usage, a 100 pF with very short leads is better. For 80 meters, the capacitance might be increased up to 330 or 470 pF. The rest of the preamplifier stage is designed for low noise amplification with a gradual roll-off below 200 Hz and above 4000 Hz. If a still sharper roll-off is desired on the low frequency end, try reducing in value the 1 mF input coupling capacitor to the filter stage. But, keep the

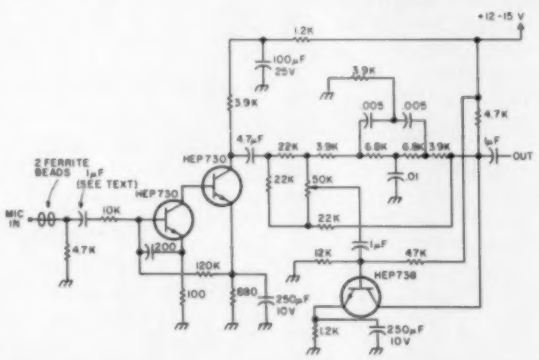

Fig. 1. Circuit of the complete unit. First two stages are a low noise preamp followed by a constant gain peaking stage.

input coupling capacitor an *electrolytic* type. The low Q of such type capacitors offers better protection against rf feedback effects than disc ceramic or paper types.

The HEP 738 peaking filter stage makes use of a parallel T network (R1-R3 and C1-C3) as its primary element with the rest of the circuitry arranged around it to provide a feedback arrangement for peaking while the overall stage gain remains essentially constant. The values shown will produce a peaking frequency of about 1500-2000 Hz. The exact peaking frequency for transmitting application does not seem to be too important if it fails within this range. Thus, nominal 10% tolerance components for the network elements will suffice. If one wants to use the filter stage as a selective filter for receiving purposes, component tolerances should be held to 5% or less. The peaking frequency can be raised or lowered as desired by adjustment of the values in the basic T network. The formula for the peaking frequency is equal to:

$$\frac{1}{2\pi \times C1 \times R2}$$

where R2 equals R3, R1 is half the value, C1 equals C3, and C2 is twice the value.

The 50k peaking frequency amplitude potentiometer will allow adjustment from a flat response (microphone plus preamplifier shaped response) to one where the approximate 1500-2000 Hz range is boosted from 0-20 dB. The determination of how much peaking effect to use is necessarily a subjective one. Probably the best method to use is to make a tape recording using good quality equipment at different peaking levels and request on-the-air comments. Make the receiving operator, however, reduce the af or rf gain on his receiver to a level where you are just intelligible under ordinary modulation conditions. The use and proper adjustment of the filter will not make the difference between a marginal and a solid QSO, but in most cases it will definitely add a noticeable degree of intelligibility and communications "punch" to the audio on any phone transmission. The reason why? There is no simple answer to this, although textbooks such as *Reference Data for Radio Engineers*, Fifth Edition, Chapter 35, will provide all sorts of interesting data on human hearing versus frequency of transmission. Perhaps one of the most interesting charts is that shown in simplified form in Fig. 2. It shows equal loudness contours versus intensity for different frequencies. The curve is generalized, of course, because of the variations in hearing with age, etc. But notice the marked sensitivity of the ear around 2000 Hz. Raising the level of sound transmission at this frequency, where the normal ear is most sensitive, will create the effect of a louder and more intelligible signal. ■

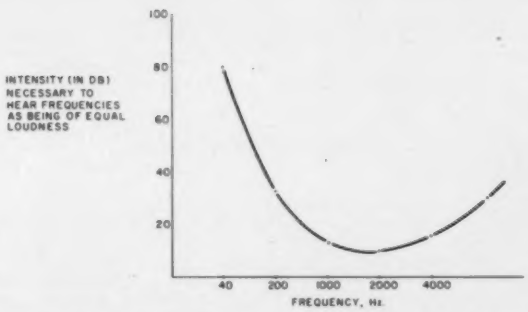

Fig. 2. The reason why boosting the frequencies around 1500-2000 Hz gives the effect of better intelligibility to voice communication circuits.

BE MY GUEST

visiting views from around the globe

from page 11

the transmitters, the Scandinavian countries were especially hard hit by the noise with their radio communications being almost completely wiped out. They poured a continuous stream of complaints into the Soviet Union. A source at the State Department called the Soviet statement "encouraging," but declined to speculate on the reason for it. He said that despite the admission, the formal complaint was sent.

Articles about the noise appeared in newspapers throughout the world. Government sources were surprised about the great degree of publicity that was generated.

The "Big Noise" is only the tip of the iceberg regarding interference. FCC files currently contain over 300 pending cases of alleged international interference.

Whether the noise will be gone for good is a fact that remains to be seen. Propagation study or transmitter test, the foibles of international politics are involved. We may not have heard the end yet.

Stan Miastkowski WA1UMV
Associate Editor

HF-Texas Style

As reported last month, a series of raids in the Baltimore area late in October netted over sixty-five thousand dollars worth of radio equipment. The engineer-in-charge of the Baltimore FCC office, Robert Mroz, told *73* that, of 19 HFers raided, criminal charges were brought against 18 by the US Attorney's office. Each was charged with between 9 and 33 counts of illegal use of radio transmitters, punishable by fines of up to $500 per day, per violation. One of those involved was a General class ham. Administrative action has been taken against his license.

Early in December, a single raid in Delaware resulted in the confiscation of HF equipment worth $1200, as well as a CB unit that was illegally modified for 40 channel use. FCC engineer Mroz said the office of the US Attorney is helping the Commission catch the illegal operators through cooperation with FCC authorities. In the case of the Delaware raid, a search and seizure order was issued the same day the HFer was located by an FCC monitoring station.

In mid-November, two FCC agents, six US marshals, and ten police officers raided a home in Houston TX. They confiscated 20 linear amplifiers ranging in power from 250 Watts to a *6000 Watt* homebuilt unit using television transmitter tubes. At press time, charges were pending against three men in connection with the raid. Houston engineer-in-charge Allan Kantrall said that it was believed that one of those facing charges was selling the linears to fellow HFers. He added that a group of neighbors applauded the confiscation, as television reception in the neighborhood had been disrupted.

Kantrall told *73* that the Houston office faces an extremely severe problem in dealing with illegal activity because the Texas area has the highest concentration of CBers in the country. The city of Houston has the greatest number of CB licenses of any city in the United States, according to the FCC. Kantrall said his "greatest headache" is the use of linears. A few years ago, power levels of one to two hundred Watts were common. But with the increase in activity, illegal operators have had to go to higher and higher power in an effort to drown one another out.

Along with the out-of-band activity and linears, the FCC engineer added there has been a huge increase in profanity and threats over the air, which has resulted in beatings, stabbings, shootings and even murder.

Kantrall hopes that a large public service effort on the part of the Houston office will help to educate the public about FCC enforcement operations and the results of illegal activity. In one recent case, FCC personnel spoke to a gathering of over 5000 CBers.

Despite a shortage of enforcement officials and monitoring equipment, FCC officials do not intend to let the illegal activity continue. Raids and prosecutions are expected to continue. In fact, after the recent raids in Baltimore, FCC engineer Mroz said that as of year's end there were "no HFers operating in the state of Maryland."

Warren Elly WA1GUD
Associate Editor

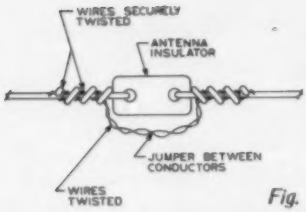

Fig. 1. Splicing technique.

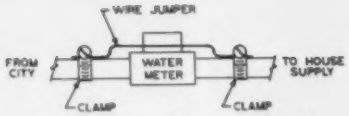

Fig. 2. Grounding technique.

Amateur radio operators are familiar with Morse code, but how many have taken the time to learn the National Electrical Code (NEC)? The purpose of this article is to familiarize you with the provisions of the NEC and how they apply to the amateur radio station and to give you some common sense applications of these rules. Compliance with these rules, by the homeowner ham, could prevent the loss of both home and fire insurance. Many insurance policies contain the clause that, if fire occurs and the investigation shows NEC violations, benefits payable under the policy may be disallowed. Ignoring the insurance requirements, the NEC provides for a safe and efficient installation and should be given serious consideration by the ham.

ANTENNA SYSTEMS – GENERAL

Material

To comply fully with the NEC, the antenna must be comprised of hard-drawn copper, bronze, aluminum-alloy, copperclad steel, or other high strength, corrosion resistant material. Soft-drawn or medium-drawn copper may be used for lead-in conductors where the maximum span between points of support is *less* than 35 feet. Table 1 shows the required size of conductors for amateur receiving and transmitting antenna systems. As you can see, most spans will require at least number 14 wire.

Outdoor antennas and lead-in conductors (including vertical antennas and dipoles) shall be securely supported. The antenna must *not* be attached to any electrical service mast or pole (this includes utility and telephone poles). No antenna can be mounted on a pole or similar structure carrying electrical light or power cables of more than 250 volts. The antenna and its supports should be located far enough away from the various power lines that in the event that the antenna or support falls, contact with these power lines will be avoided.

To apply this rule for, for example, a 21 foot vertical, locate your antenna so that if you were to visualize it as the center of a circle with a radius of 21 feet, at no point in that circle would you find a power carrying cable. If you are able to find a clear 21 foot radius, you have found the best location for your mast.

A sturdy mount and enough guy wires to provide the necessary strength to withstand ice and wind loading conditions should be installed. The guy wires should be located well away from overhead conductors of electrical light and power circuits.

Avoidance of Contact With Other Conductors

Outdoor antenna and lead-in conductors from the antenna to a building should not cross over electric light or power circuits and should be routed well away from these power lines to preclude accidental contact. If proximity to power service conductors carrying *less* than 250 volts cannot be avoided, there must be at least two (2) feet of clearance.

The code recommends that these antenna conductors be installed in such a manner that they neither cross *over* nor pass *under* power carrying conductors. The reasoning is sound: In the event that your conductor was above the power line and fell, it would short the power cable and impress high voltages into your antenna system and allied equipment. Conversely, if your cable was below the power line and it fell, the power conductor would short to your system and again impress a voltage on your system, causing a safety hazard.

Splices

Any and all splices on the span should be made with approved splicing devices and offer a firm mechanical joint. Soldering may ordinarily be expected to weaken the conductor. One method is to use an antenna insulator (as shown in Fig. 1) and jumper between the two sides. This will provide a firm mechanical connection as well as an

Are You Really Insured?

- - time to read the fine print

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Chicago IL 60659

electrical path. Several layers of electrical insulating tape may be applied to the splice if desired.

Grounding

The NEC requires that masts and supporting structures be permanently and effectively grounded with no splice or connections made to the ground wire. The easiest method of providing a good ground is taken from the telephone company and requires that a conductor of at least AWG 12 (copper) or AWG 8 (aluminum) be run from the mast to the cold waterpipe. The lawn sprinkler faucet located on the outside of many homes is a good termination point for our ground.

In order to use this system, you must first verify that there is a direct metallic path through the cold water pipes. A visual inspection will show you if you have metal or plastic pipes. Assuming that you have metal pipes, follow them to the water meter.

Use your ohmmeter to verify an electrical path through your water meter. This is necessary because certain water meters have an insulated coupling. If you do not have a metallic path through the meter, refer to Fig. 2 and sand or file an area at least two inches wide around the pipes. Coat this shiny area liberally with Vaseline and install two grounding clamps (one on each side of the meter). Run a conductor of at least AWG 14 between the two clamps and connect the ends of this wire to the clamps. You have now made a metallic path, and can use the outside faucet fitting for your ground termination point. Prepare this pipe in the same manner as you prepared your water pipe bridge and fasten your ground wire securely to the ground clamp.

Alternatively (in the case of plastic water pipe), drive a ground rod into the ground and connect the ground wire firmly to the rod. Because of the differences in soil resistance, the water pipe method of grounding is recommended wherever feasible.

Lead-in Conductors

Lead-in conductors for amateur radio stations shall be at least as large as the antenna conductor shown in Table 1. For example, a long-wire antenna fed with a single wire should carry the same sized conductor for the antenna and the lead-in (150 foot antenna – AWG 14).

CONNECTIONS TO BUILDING AND SYSTEM

Clearance on Buildings

The antenna conductors, if attached to the building, should be firmly mounted clear of the surface. These standoff insulators must provide three inches of space between the wall of the building and the conductor. In the case of a permanently and effectively grounded wire enclosed in a continuous shield (coax), the three-inch requirement is negated.

Entrance to a Building

Except in the case of coaxial feedlines, all lead-ins should enter the building by one of the following methods:

1. Through a rigid, noncombustible insulating tube or bushing.
2. Through an opening provided for that purpose in which the entrance conductors are firmly secured to provide a clearance of at least two inches.
3. Through a drilled window pane.

Safety and Protection

Protection Against Contact: Each conductor of the outdoor antenna should be located in such a manner that accidental contact with them is difficult or impossible.

Lightning Arrestors – Transmitting Stations: Each conductor of an outdoor antenna should be provided with some method of static charge drain (either a switch or lightning arrestor). The only exceptions to this requirement are as follows:

1. Where the conductor is protected in a continuous metallic shield (coax) and is permanently and effectively grounded.
2. Where the antenna is permanently and effectively grounded.

Material	Minimum Size of Conductors When Maximum Open Span Length is Less than 150 feet	Minimum Size of Conductors When Maximum Open Span Length is Over 150 feet
Hard-drawn Copper	14	10
Copperclad steel, bronze, or other high strength material	14	12

Table 1. Amateur station antenna conductors.

System Grounding Requirements

Grounding systems for the transmitter and the receiver follow the same basic rules set forth in the section on antenna grounding. However, the size of the conductor must not be less than AWG 10 (copper) or AWG 8 (aluminum).

Interior Installations

It is advisable to have a separate power line for radio transmitting equipment. Ideally this should be run in separate conduit or Bx (consult local electrical code) and separated from the normal house power wiring by at least four inches. This circuit should be fused and the conductors capable of carrying the rated current load. Past experience in installations has shown that if one takes the entire current requirement and allows about a 25% safety factor for future expansion, this total figure will give a much more realistic guideline to the choice of conductors. For example, if we calculate that our total current drain is 15 Amps and we allow an additional 5 Amps for future expansion, we arrive at a figure of 20 Amps. The wire table shows that the best choice of wire size for this load would be AWG 12. Fusing should also allow for this current level but should not exceed the current carrying capacity of the wire chosen.

Transmitters – General

The transmitter should be enclosed in a metal frame and have a barrier (either panel or mesh) separating the inner works from external contact. (The transmitter cabinet fulfills this requirement.)

All external metallic handles and controls accessible to operating personnel should be effectively grounded.

No circuit in excess of 150 volts should have any controls or parts which carry this voltage exposed.

All access doors should be provided with interlock switches which will disconnect voltages in excess of 350 volts when these doors are opened.

SUMMARY

We have explored the code and seen that many of its requirements are founded on safety. It would be wise to abide by the dictates of the NEC. This will increase the safety and efficiency of your operation. Using common sense, a grounding rod and interlocks on your transmitting equipment will help avoid injuries and enhance your enjoyment of amateur radio.

Before implementing these rules, check with your local electrical inspector and get a copy of your local electrical code. There may be some deviations from the NEC, and, in order to be safe and legal, you must be aware of all local as well as national electrical code requirements as they apply to amateur radio stations.

Remember, the code complying station is a safe station . . . so let's code it. ■

Getting a Patent -- Is It Really Worthwhile?

-- how to do it, if you really want to

George A. H. Bonadio W2WLR
373 East Avenue
Watertown NY 13601

Because of the very nature of our amateur hobby, we have more inventors per banquet table than at any other conventions. Inventors bring up the idea of patents. Patents bring up thoughts of publications from the Commissioner of Patents, like: "Rules of Practice," "Answers to Questions Frequently Asked About Patents," "Patent Laws," "General Information Concerning Patents," "Office Consolidation of the Patent Act," "Guide for Patent Draftsmen," and so on, little of which I want to mention here.

Besides completing a course on patents and their management, I have seven patents, an eighth applied for, several abandoned, one infringed and the usuality of none producing an income.

What Is A Patent?

Your patent is a legal document proving that you first made public a "new and useful device, process or plant" and therefore can legally go to court and "start an action" against someone else who refuses to recognize your monopoly rights so granted. In this court action you are alone. The government will not help you.

Your patent (and its rights) is a thing which you can sell entirely, or in part, or license out under any kind of restrictions, or keep all to yourself. It lasts 17 years from its "date of issue."

What Does It Entitle Me To?

For 17 years, if you do not dispose of it, it entitles you to charge all the traffic will bear upon all those who will commercially use your patent. It lets you spend a fortune in each court "action." If you are "small" and it is "big," you can expect some legal rough-and-tumble action with it before the end of 17 years. You can sue up to triple damages on infringers, who will be ready for you. They may counter with a suit that proves that your patent is invalid, for some little oversight. Then you are entitled to pick up the heavy court costs.

How Do I Proceed?

Be sure that you have something which is "new and useful." Send $3.25 to the Superintendent of Documents, Washington, D.C. 20402, for a copy of "Patent Attorneys and Agents Available to Represent Inventors Before the U.S. Patent Office."

Find the nearest several patent attorneys, who do not advertise, and write or call each, asking, "Do you handle electronic patent applications for private inventors?" Do not use an attorney who discourages a preliminary visit by you.

You will have to trust this attorney in many facets. Be sure he has a good reputation. Inquire around. Ask him who he has worked for in the past and talk to them.

You cannot assay the market for your item by yourself. You are too biased. You must use friendly advice. I'll tell you now that it will be darker than your outlook. Companies spend heavily to introduce new items. Is yours worth it?

Is It Patentable?

A "search" by your attorney's agent in Washington will cost up to $100. It will pop up with patents back to the last century (which were better than your idea) or a diagram from the pages of *73 Magazine* which is completely unrelated, you point out.

I "invented" a terrific navigational device for the last 200 feet of a plane's descent onto a runway (using 7 kHz and 9 kHz whole field loops) only to find it had been "issued" the very day I "invented" it. (Yes, I'm good at ESP, giving demonstrations at conventions.) However, the real inventor has not gotten it onto the market. It is simple, foolproof, unobstructive, workable in a power dead plane, inexpensive, and on and on, but it expired in 1961, unused.

Is It Competitive?

If your invention costs more and does less, you are dead. If it costs less and does more, you still have only a fighting chance. It has to be much better on the market than what is there now, or you will not even get a hearing. Even if it is good, who is going to risk his present profits to see if the crazy consumers will do him much better on your item?

Who Will Market It?

A company with back orders now may tell you to go away. A weak company may tell you that it cannot afford the big risk to tool over to your invention. A speech compressor company doesn't care about your new antenna system.

Your best marketer is your own company, and the best patent is one developed for your own company to advance on from its present successful position.

Patents from outside a company are immediately suspect. They are not in line with plans. They can embarrass the company engineers. The claims may not be well-written for their uses.

Where Is A Patent Attorney?

He is on the other end of your phone or letter, or in court. If he does not go to court for his clients, he may not be able to help when you most need someone who understands all of your patent.

He is in there working with you on your selling or licensing agreement (in his office, not yours). Your regular lawyer is not very informed on patents. Patent laws are in a world by themselves.

If you cannot spare a thousand dollars and a hundred hours per patent application, don't start. There are filing fees, artist fees, attorney fees, and final fees, at least, on top of mail and phone and travel in business hours.

Less than one quarter of one percent of patents "issue" on the first "action" by the Patent Office "examiner." However, my Box Diagonal Antenna did, and this saved me, perhaps, $200 in additional fees. My attorney and I would have had to argue around the examiner's "action" with a new "response" material, if I could, or "abandon" the whole thing. Sorry, no refunds.

The attorney, if he is experienced in working for corporations, can do an excellent job for you. If he is an advertising attorney, he cannot show you that one half of one percent of his inventors have ever made a profit on any one of their patents. Most of the corporate patents are credited with netting $1, or more. Think about it.

What Do I Claim?

Your attorney will have to rewrite what you claim in language you can scarcely understand. What you display, but do not claim, is gone. What you claim, but which the examiner "disallows" or "rejects," is lost.

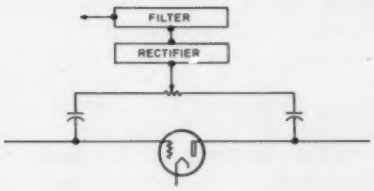

Fig. 1. The Bonadio Automatic Distortion Control, Patent #2,634,339. The tap position is at the null of detection, with distortion-free output. Any distortion will produce a detected signal at this setting, and can be used for automatically controlling the distortion level.

When your claims are long and have many conditions, they are "narrow" and cost more for attorney's fees than they are worth to you or anybody else.

The only test of a patent is in court, which you would rather not invite. A good patent is in a newer field, like electronics, rather than mechanics, and has no near misses in the "search," no near collisions with the "examiner's actions," has a few adjustments of the "claims" to satisfy the examiner, and covers all possible variations by an "omnibus claim," which covers the field like a tent.

How Secretive Must I Be?

Ask your patent attorney. On a simple patent, he may have you out hawking it after it has been filed for three months or, if it is a complicated patent, after six months from filing date. After you file an application, a later similar filing, by another inventor, produces an "interference." The later inventor must prove that he was "diligent" in getting his application filed, even while he must also show that he actually invented it, or "reduced it to practice" before you did. He's got troubles.

My fastest invention took months to prepare for filing, only 23 months in the Patent Office, and issued July 1, 1969. It had no extra "actions" and "responses," which could extend a few years its time while "pending."

After your patent attorney has notified you of your filing date and number, you must, in public, refer to your invention as "patent applied for," either by a note in the text or by putting that phrase on the item for sale, or you can lose your rights.

Later, after the examiner has allowed one or more claims, you must refer to it as "patent pending." Actually, you may obtain more claims many months later, and then "issue" six months or more after that.

As soon as you conceive it, or even before, you can contract to sell it, say, to your employer, as part of keeping your good job. Have your patent attorney do all the contract paper work, even if your company has its own patent attorney. Yours will earn his pay for you.

If it's a company patent, you may get a guaranteed first option on any job in the company for which you can qualify, during the life of the patent. You might extend this to your child, and even to your family, if the patent is valuable in keeping the company going. This type of payment can be a bigger reward than any cash outlays that the company can afford.

This department is where your patent attorney's talents will show up – trust him.

What's An Interference?

It's a signal that two minds are on the same idea and filed patent applications at nearly the same time. If you filed second, save your money. Abandon it right there.

If you filed first, and the other party is in a company which was planning to use it, you have a captured audience. Have your attorney contact them at once to see about improving the claims to satisfy them and to license the application to them the best way your attorney can.

What If My Claims Are Rejected?

Then you have wasted considerable time and money. Forget it. Abandon it. A true inventor has more good ideas than he can afford to try and probably has an application brewing at all times.

Should I File?

This question finally has to be answered. If you are working in, for, or with a company which will use the patent, by all means, yes. If you have a financial backer, whom you do not have to repay (by a contract approved by your patent attorney), again, yes. However, if you are like the 220 private inventors who attended an inventors' convention in Cleveland, who all agreed that none, representing about 400 patents, had made a profit on any one patent, the answer is no.

The typical private patent covers an invention which not enough people either need, want, will pay for, or will switch over to. This typical home invented patent does not fit in with any manufacturer's planned progression.

If your patent, like my Automatic Distortion Control (Patent #2,634,339), can be buried in a large electronic device, forget it as a private invention. I can show how I was invited by the military to sue for damages; they even gave me the contract numbers. Two manufacturers, whose names you know, have used the ADC. Possible royalties are not worth the tens of thousands of dollars I would have to risk to fight the cases.

The Bonadio Automatic

Distortion Control is the ultimate in electronic simplicity, a desirable patent trait. In Fig. 1 there is a blocking capacitor, or two; a bridging resistor between input and output of a tube, valve or transistor; a tap on that resistor leading to a detection unit, such as a diode; and a filter. Without distortion it detects no signal, the tap being at the null. As distortion increases, the null point moves away and useful output develops, which can be used to reduce both the gain and the distortion. For example, on a transistor radio it would hold the audio output to all the quality output possible, even following a dying battery down in output. Imagine all transistor radios with no audible distortion!

Unless you are a big manufacturer, you cannot police infringers on this size device. I can't. An infringement suit could cost me $40,000 if I lost, to say nothing of the years of anxiety involved. One's health has quite a value, too.

As long as a manufacturer knows that I cannot afford to sue him, he knows that he can use it without fear from the patent owner. He will never buy it from me under these conditions.

His only fear would be that I might put it into profitable use myself, and then be able to sue him. While this hope, on my part, is futile for my ADC, it could happen with something wholly covered by patents and harder to bury, such as my several antennas. However, he can see my operations and calculate my actions years in advance and prepare to negotiate, fight or abandon the device. He knows that no other manufacturer will be foolish enough to pay for what he, too, can have free, especially in a small device.

What's The Success Ratio?

Aiming to increase my success ratio, my latest patent applications and patents have been in units entirely covered by a patent, not just a small bit circuit in a huge monster assembly. Not only that, but they stand exposed outdoors – for all to see, instead of buried, as in the ADC.

I estimate my first antenna patent possibility of producing a profit at about one in 500! With the related second patent I probably improved my chances to one in 50. Now, with the third, a "continuing patent," I believe that my chances are as good as one in five! I have had some encouraging results on one more patentable advance on these. If it works out, some years from now I should be able to negotiate.

How Do I Negotiate?

You negotiate through your attorney, at about $25 per hour. You don't make a move without his approval. He will probably let you advertise to your heart's content after you have been filed for three months or more.

Your problem is to find someone who can be convinced that he cannot afford to ignore your patent – and to convince him of this fact. I found that antenna companies receive about a dozen offers a year. Compare this with the number of really new antennas on the market each year.

Nobody Wants Them?

I mailed 157 notices to antenna companies. Seven addresses were returned as "unknown." Five gave useless responses. Then I mailed a series of three hard hitting letters to 19 likely manufacturers. Four (a splendid response) inquired further. None want to test under the conditions I recommend.

Although I warned that my antenna "effects" happen only in the ionosphere, one turndown referred to a computer test and another to an all earth test range. No company has tried them in the ionosphere yet.

A small, friendly manufacturer, whom I phoned, told me that he could not sell his patents either, so he and his wife struggled for ten years and now are doing fine as a manufacturer. He suggested the same route for me.

Use Them Or Lose Them?

Because of the fast moving electronic advances, patents are generally estimated to have a 5 year profitable life, out of their 17 year legal life.

Like anything else, if you don't use them, you lose them, and I estimate that I have spent over 1,000 hours on these few.

What Should Be Done?

Don't become like the neurotic inventor, who produces a patent that only he could love and then spends the rest of his life wasting his time, money and health trying to force it on a world which won't have it.

Don't deprive your family of its needs in order to obtain a $1,000 patent. The odds are over 200 to one against getting your money back.

Don't expect a patent sales agent, to whom you are fair game, to sell your patent any better than you can, for his price. He doesn't sell 1% of his customers' patents.

Don't keep an invention buried until you can afford a patent. Name the circuit after yourself and sell a story about it to the editor. He will pay you for the story. If the circuit is continuously usable, you will have your name hung on it, and you will be immortal. That's better than an expensive dead patent which you might, helplessly, see infringed under another name (my ADC infringements were under two other descriptive names) after you paid for a patent to have your own name known.

Do ask the editor to spell your name right, like B-O-N-A-D-I-O's ADC. ■

Social Events

from page 22

Annual Ham Auction, Sunday, March 20, 1977 at the Lucas County Recreation Center, Maumee (Toledo), Ohio. Auction, flea market, commercial displays and good eyeball QSOs. Time: 8 am to 5 pm. Admission: $2 advance, $2.50 after March 1, 1977 or at the door. Talk-in on 52-52 and all Toledo area repeaters. Send SASE, Toledo Mobile Radio Association, Inc., Box 7548, Oregon OH 43616.

COLUMBUS GA
APR 2-3

The Columbus, Georgia Hamfest will be held April 2 and 3, Palm Sunday weekend, at the Fine Arts Building at Fairgrounds, 9 am to 4 pm daily. Flea market, ham auction, prize drawing at 1:30 pm Sunday, talk-in 28/88, 3975 kHz, buffet dinner Sat. at 8 pm. For more information write K4JNL. Advance tickets: K3MTY/4, Rt 5, Box 750, Phenix City AL 36867.

GRAND RAPIDS MI
APR 2

The Third Annual Swap and Shop will be held at the Northeast Jr. High School, 1400 Fuller Ave., N.E., Grand Rapids, Michigan, on Saturday, April 2 from 9 am to 5 pm in the cafeteria. Featured will be: CBs, monitors, ham equipment and electronic parts. For further information contact Grand Rapids React at the above address.

ST. CLAIR SHORES MI
APR 3

The South Eastern Michigan Amateur Radio Association is holding its Nineteenth Annual Hamfest on April 3, 1977 from 8 am EST to 3 pm EST. It will be held at the South Lake High School in St. Clair Shores, Michigan, 21900 Nine Mile Road and Mack Avenue. For further information contact Dorothy Spilski WB8PRJ, Secretary S.E.M.A.R.A., 11906 Riad Avenue, Detroit, Michigan 48224, 313-521-6646.

PLAIN CITY OH
AUG 14

Hamfest 77 is to be held on Sunday, August 14, 1977 at the Plain City Fairgrounds, Plain City OH. Talk-in on 146.16/76 or 146.52. Advance tickets $1.50 – gate $2.00. For additional information or reservations, write UCARC, 13613 U.S. 36, Marysville OH 43040, or call Gene Kirby W8BJN 513-642-9861.

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Keeping the Wind Down

-- timer for your mobile rig

"Timing a repeater out," as the jargon goes, may not seem to be a significant event for the user, but it can generate a fury of activity on the part of the control station. With the addition of the timeout timer/alarm shown here, one can help minimize repeater timeouts.

The timeout timer/alarm does essentially one thing — keeps track of the length of time that your transmitter is on, and if it has been on longer than its timing period, deactivates it and sounds an audible alarm in the rig's own speaker. Resetting the circuit is accomplished by releasing the PTT button. If transmissions are made of durations shorter than the timing period, the normal operation of the transceiver is not affected.

The circuit operates in the following manner: Under normal conditions, point D on the schematic (collector of Q2) follows point A (base of Q1); that is, grounding point A provides a transmitter PTT ground output at point D. Generation of the warning tone and elimination of the PTT signal only occurs when point C is low and point B is high. This condition only exists if the PTT button is held in after the timer A1 has disabled the transmitter. The warning tone generated by timer A2 produces a tone in the transceiver's speaker at this time. Once again, resetting the circuit by removal of the PTT ground at point A instantly readies the rig for normal operation — until you talk too long again!

Construction is relatively simple, and should probably begin with the selection of R3 and C3, the main timing components. These values can be selected from the table or by calculation (Fig. 1). A potentiometer could be substituted for R3, but in my prototype I was interested in conserving space. My prototype was constructed on a 1" by 1.5" board and was installed in an Icom IC-230.

Hookup of the circuit requires that you break the normal PTT line, reconnecting it to points A and D, attaching the free end of R7 to the positive speaker terminal, and applying +12 volts and ground.

This circuit has already proven itself useful on more than one occasion, and I hope others will find it handy in helping to prevent unnecessary repeater timeouts. I would also like to thank Bruce Bechtol K8VAK for his assistance in the circuit's design. ■

1 Megohm Resistor

Time in Seconds	Capacitor in uF
30	27
60	54
90	81
120	109
150	136
180	163

1.5 Megohm Resistor

Time in Seconds	Capacitor in uF
30	18
60	36
90	54
120	72
150	90
180	109

2 Megohm Resistor

Time in Seconds	Capacitor in uF
30	13
60	27
90	40
120	54
150	68
180	81

Fig. 1. R and C for timeout timer. $T_{(seconds)} = (1.1\ R3C3)$.

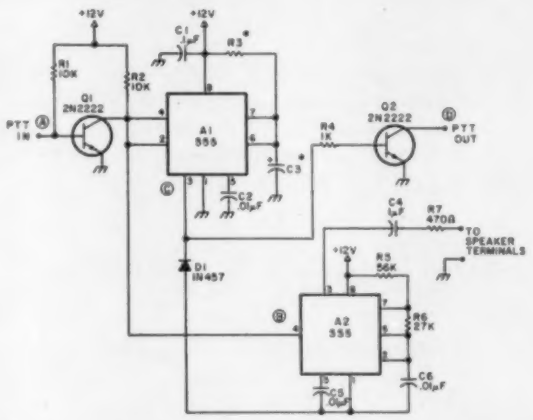

Fig. 2. Timeout timer with audible alarm. C1 — .1 uF disc; C2, C5, C6 — .01 uF disc; C3 — see text; C4 — 1 uF 12 volt capacitor; R1, R2 — 10k Ω, ¼ Watt; R3 — see text; R4 — 1k Ω, ¼ Watt; R5 — 56k Ω, ¼ Watt; R6 — 27k Ω, ¼ Watt; R7 — 470Ω, ¼ Watt; D1 — 1N457A diode; Q1, Q2 — 2N2222; A1, A2 — NE555V.

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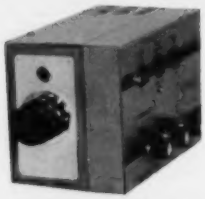

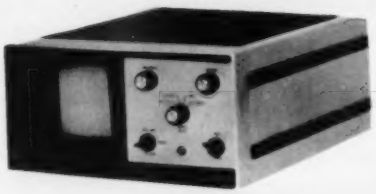

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SSB: The Third Method

- - bet you can't even name the first two

I first ran across this particular method of SSB generation some years ago when involved in a communications course. At the time I was deeply involved with getting a phasing type SSB generator on the air and only gave this method a casual glance. Never having heard of this method in the amateur journals, or of a commercial unit using this type, I was inclined to write it off as an impractical method, as I am sure many others have done before and since. This assumption couldn't be further from the truth, as the Third Method is in direct competition with the filter method. It requires neither sideband filter, nor wideband audio phase shift network (as in the phasing method), does not require critical adjustment, and any misadjustment results in interference to the user only.

As you can see, this method has much to offer the radio amateur and indeed the commercial user. The original paper on this subject was by D. K. Weaver, Jr., titled, "A Third Method of Generation and Detection of Single Sideband Signals," *Proceedings of the IRE*, December, 1956. At present this method is used in commercial equipment manufactured by Redifon Telecommunications, England, and has been since a unit was introduced in 1960.

Enough of the selling job on the Third Method – let's get into the circuit description. If you will refer to the block diagram of Fig. 1, you will note that we have four balanced modulators. These can be of any configuration. Balanced modulators A1 and B1 are operating at audio frequencies, so layout is not too critical. The circuit also requires phase shift networks. Since these are operating at only one frequency, obtaining an exact phase shift is no problem and even RC networks can be used. This application also lends itself well to digital schemes, one of which is shown in Fig. 3. The low pass filter (the one from the original paper is shown in Fig. 4) is also operating at audio frequencies and can be constructed using LC networks. It is also possible to use active audio filters.

The input audio consists of 300 to 3,000 Hz, the normal bandwidth of speech communications. When these frequencies are mixed (in balanced modulator A1) with the 1800 Hz oscillator, the modulation products that appear in the output are as shown in Fig. 2(b). In particular, note that the lower sideband is "folded" over. This results from the choice of carrier frequency. The carrier frequency is actually in the middle of the audio spectrum to be transmitted. As an example, consider an input audio signal of 500 Hz. When it is mixed with the carrier frequency of 1800 Hz, the modulation products (sum and difference components) are 1300 Hz and 2300 Hz. Next consider an input audio frequency higher than the carrier frequency, for example, 3100 Hz. When it is mixed with an 1800 Hz signal, the modulation products are 1300 Hz and 4900 Hz. Thus at the output of balanced modulator A1 we have a lower sideband which has the audio frequencies higher than 1800 Hz folded back on top of the lower audio frequencies – and all this is contained in a bandwidth of 1500 Hz. An upper sideband also extends from 2100 Hz to 5100 Hz. The upper sideband is then filtered out by the low pass filter, leaving only the lower sideband as shown in Fig. 2(c).

This "folded" lower sideband is then applied to balanced modulator A2, where it is mixed with the rf carrier.

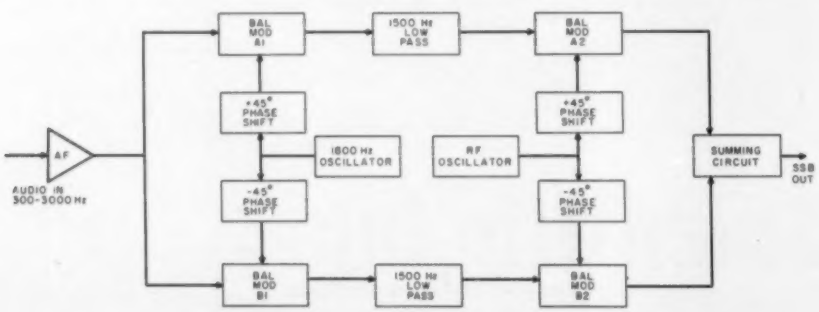


Fig. 1.

The rf carrier may be the operating frequency, or a lower frequency which is then heterodyned to the operating frequency. The output of this balanced modulator is shown in Fig. 2(d). It consists of the 0-1500 Hz "folded" sideband from modulator A1 as two double sidebands of the rf carrier, which is balanced out in A2. A careful analysis of this diagram will reveal that we are once again back to our original bandwidth of 3,000 Hz. Also, because there are both high and low original audio frequencies represented in both the resultant sidebands of balanced modulator A2, we will have both inverted and direct speech contained in the 3,000 Hz bandwidth of Fig. 2(d).

It has been shown by the phasing method of SSB generation that by using two modulator chains of the proper phases we can generate two sets of sidebands, which when added together result in cancellation of the unwanted sideband and reinforcement of the wanted sideband. Much the same technique can be used here, with the Third Method. By using two modulator chains, as shown in Fig. 1, and the proper phase shift networks (quadrature), which as stated before are for only one frequency and can be made to exhibit the exact phase shift needed with little trouble, and then adding the output of these two chains, we can reinforce the wanted sideband and cancel the unwanted sideband. The result is illustrated in Fig. 2(f). For additional clarity, the outputs of modulator chains A and B are shown in Fig. 2(e). Note that both sidebands occupy the same frequency spectrum, as well as the 180 degree phase difference between the lower sidebands.

It can be seen in Fig. 2(f) that the carrier frequency of the SSB signal, in this case for upper sideband, appears 1800 Hz below the rf oscillator frequency of the generator. This means that the carrier frequency of the sideband signal is actually not generated (due to the use of the folded sidebands). Therefore, any misadjustment of the final balanced modulators will result in the rf carrier appearing in the middle of the sideband spectrum and causing an 1800 Hz tone to be heard on the receiving end. The important fact is that no out-of-channel interference will occur. Only the user will suffer from misadjustment. Another important fact is that if there is incomplete sideband cancellation, again no out-of-channel interference will occur. The unwanted sideband will appear in the same spectrum as the wanted sideband, causing interference to the user only.

This method of single sideband generation has some very positive advantages over both the filter method and the phasing method of single sideband. I have included some sample circuitry of various parts of the Third Method SSB generator. If you are considering building an SSB generator, I hope that you will give serious consideration to the Third Method. Though it is rather complex, the construction and alignment is simplified, due to the fact that most of the circuit is at audio frequencies. The advantages are many. If anyone is interested in a more detailed and mathematical description of the circuit operation, any of the references listed will be of help. Good luck with

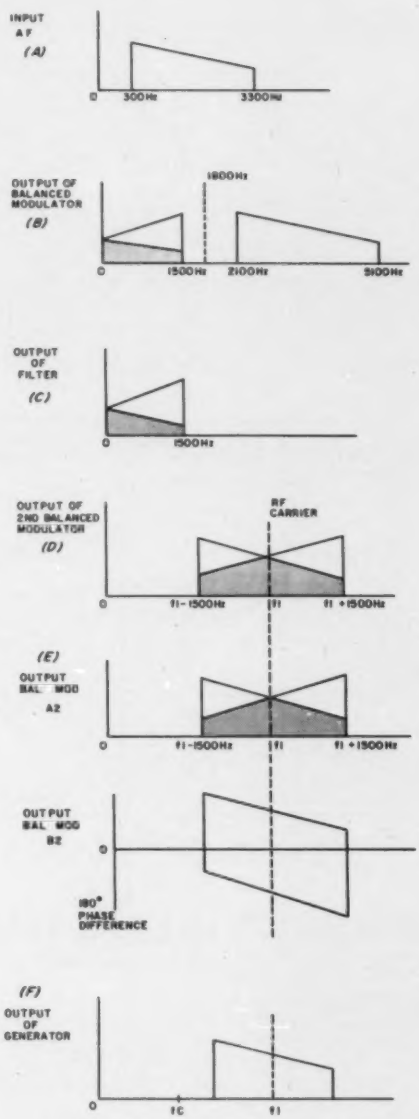


Fig. 2. (a) Represents average speech power distribution. (f) $F_C = F_1 - 1800$ Hz (upper sideband output).

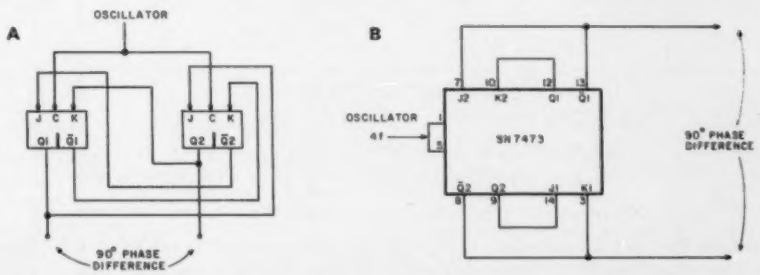
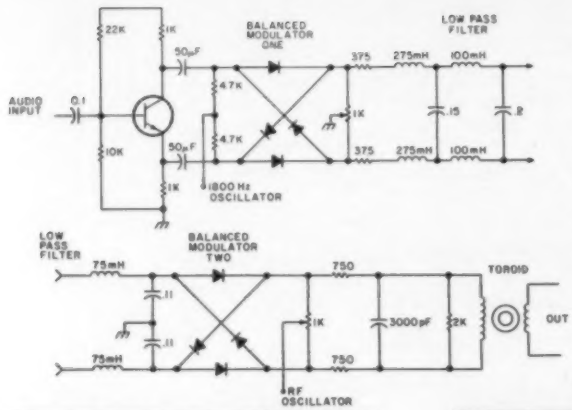


Fig. 3. (a) Using two JK flip-flops to obtain a 90° phase shift for use in Third Method generators; oscillator frequency must be four times the desired output frequency, i.e., for 1800 Hz output, oscillator frequency is 4 x 1800 = 7200 Hz. (b) 90° phase difference network using dual JK master-slave flip-flop 7473.



building a Third Method generator, and I hope to hear many of you on the air. ■

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D. K. Weaver, Jr., "A Third Method of Generation and Detection of Single Sideband Signals," *Proceedings of the Institute of Radio Engineers*, 1956, p. 1703.

J. F. H. Aspinwall, "The 'Third Method,'" reprinted from *Wireless World*, January, 1959, courtesy Redifon Ltd., England.

Pat Hawker G3VA, *Amateur Radio Techniques*, Fifth Edition, Radio Society of Great Britain, 1974, pp. 40-41.

George Kennedy, *Electronic Communication Systems*, McGraw-Hill Book Company, 1970, pp. 144-147.

Capitol Radio Engineering Institute, Washington, D.C., "Single Sideband I," copyright 1958, McGraw-Hill, 1974 Edition, pp. 33-38.

Fig. 4. Example of modulator-filter chain for Third Method generator. Two are required for complete generator. All diodes: 1N34. Any NPN transistor is suitable. Summing of both modulator chains can occur at toroid.

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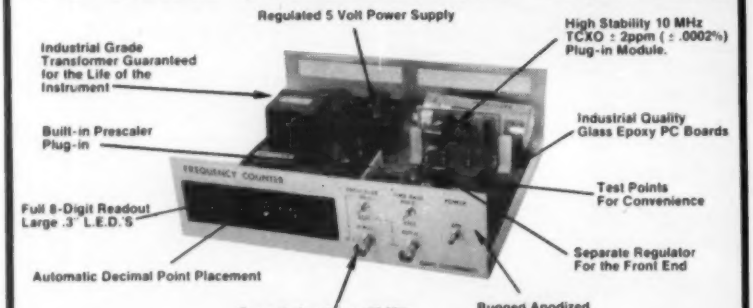
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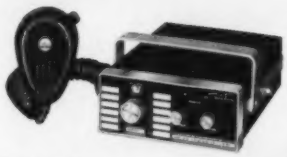

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- - another digital building block

Many amateurs are afraid to build projects using integrated circuits, either because they do not know what is going on inside the chip, or because they think that they need a room full of test equipment to get the project working. What follows is a description of four types of TTL (Transistor-Transistor Logic) monostable multivibrators, or one shots, along with some simple circuits that are useful and easy to get working. No special components or printed circuit boards are needed, and most of the necessary supplies may be found in hobby-type electronics stores.

The one shot is a nifty device that can find many uses around the shack. Basically, the one shot will put out one pulse of a specific length, regardless of the shape or duration of the input signal. A retriggerable one shot is one that may have its output pulse extended by supplying one or more additional signals at the input before the end of the output pulse. The output pulse will end after the normal time interval after the last input. Example: If you have a non-retriggerable one shot that has been set for an output pulse width of one second, and you apply a very short input pulse to it every three-quarters of a second, you will get a string of 1 second pulses out with a space of ½ second between each pulse. If the same input were applied to a retriggerable one shot, you would get a continuous output until 1 second after the last input pulse.

Fig. 1 shows the pin assignments and function tables for the 74121, 74122, 74123, and 74221 monostable multivibrators. The inputs labeled A on the pin assignments diagram are the negative-transition triggered inputs. A signal at these pins will trigger an output pulse when it transitions from a high level to a low level if all other inputs are high. The inputs labeled B are the positive-transition triggered inputs, and will cause an output pulse to begin when the input at these pins goes from a low level to a high level as long as any other B inputs are high and at least one A input is low. For these TTL devices, a high should be between 2 and 4.5 volts and a low should be from 0.8 to 0 volts.

The outputs from these one shots are complementary: The Q output is normally low and goes high when the input is triggered, the $\overline{Q}$ (pronounced Q-not) output is normally high and goes low. The length of the output pulse is determined by an external resistor and capacitor connected to the pins marked Rext/Cext and Cext for each one shot. The length of the output pulse may be determined from some involved equations provided on the manufacturer's data sheet for each type of one shot. For amateur purposes, the pulse length may be approximated by

$$T = K \cdot Rext \cdot Cext$$

where:

T is the pulse length in milliseconds
Rext is in k Ohms
Cext is in microfarads
K = .7 for the 74121 and 74221, .32 for the 74122, .28 for the 74123

The 74121 and 74122 have internal fixed resistors, marked Rint on the diagram, which may be used as all or part of Rext. The value of Rint is 2k for the 74121 and 10k for the 74122.

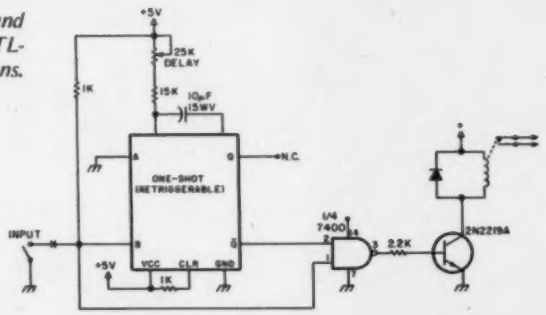
Perhaps the best way to become familiar with these one shots is to build some small practical circuits. Fig. 2 is a simple T/R switch (or VOX, COR, etc.). This circuit uses a single retriggerable one shot and one NAND gate.

The output of a NAND gate is high unless both inputs are high. In this circuit, the input and the $\overline{Q}$ output of the one shot are both normally high and hold the output of the NAND gate low, so the transistor will be off and the relay will be de-energized. When the input goes low (during key down, speech, or whatever), pin 1 of the 7400 goes low and pin 3 goes high, causing the transistor to conduct and closing the relay. When the input returns high, the positive transition at the B input of the one shot causes the $\overline{Q}$ output to go low for the period determined by the DELAY potentiometer. This keeps pin 2 of the 7400 low and pin 3 high for the time between dots or dashes and will time out and cause the relay to de-energize if another input signal does not occur before the end of the delay period. Either the 74122 or ½ of a 74123 retriggerable one shot may be used in this circuit, but the input must be kept compatible with the TTL devices (between 0 V and 4.5 V). Unused B inputs should be tied to Vcc through a 1k resistor. Unused A inputs should be tied to the A input that is used. This is true for all of the circuits described here.

A square wave generator or pulse generator is shown in Fig. 3. The 25k dual pot will give an almost symmetrical output waveform. Two single pots may be used if the up time and down time of the output are to be adjusted independently. When the switch is in the OFF position, the A input of A1 is held high and prevents any output. When the switch is moved to the ON position, the negative transition at the A input causes the Q output of A1 to go high for the time T_1 determined by the setting of the FREQ pot. Then, when this pulse falls, it triggers the A

Technical data and pin assignments diagrams for this article were taken from the *TTL Data Book for Design Engineers*, First Edition, published by Texas Instruments, Dallas TX.

Fig. 2. A simple T/R switch using a retriggerable one shot and one NAND gate. Switch may be removed and other TTL-compatible input applied at point X for practical applications.



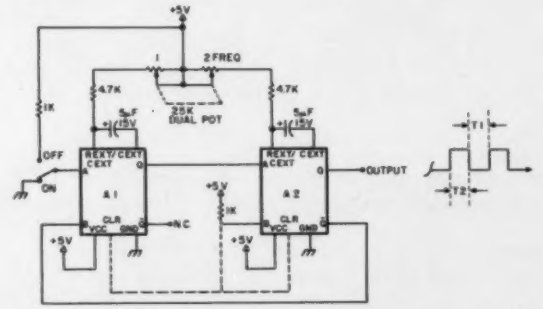


Fig. 3. Square wave generator using two single or one dual one shot. Dotted lines from CLR inputs are not used with chips that do not have clear inputs.

input of the second one shot, A2, and the output is taken from the Q output of A2. The $\overline{Q}$ output of A2 rises at the end of time period T_2, and triggers the B input of A1 to start another sequence. This will continue until the switch is turned OFF.

With the short pulses encountered in TTL logic, an oscilloscope is almost a necessity, but a good oscilloscope may cost a small fortune. Fig. 4 shows a gadget that is useful for "viewing" the workings of TTL logic if you do not have an oscilloscope available, and can be a handy accessory even if you do. The one shot is used here to light LEDs when transitions of the input are detected. Even very short pulses are visible on the LEDs, since the one shot "stretches" the pulse length. One half of a 74123 is used to detect positive-going transitions and light D1. The other half detects negative-going transitions and lights D3. D2 will light any time the input is at a high level. If the input is a constant high level, D1 will blink on and then go off because of the positive transition when you first apply the input, and D2 will come on for the duration of the high level. When the input is removed, D2 will go out, and D3 will blink on and then go off because of the negative transition. If the input is a series of pulses, the LEDs will either blink in sequence or stay on all the time, depending on the pulse width and

FUNCTION TABLE (EACH MONOSTABLE)

INPUTS			OUTPUTS	
CLEAR	A	B	Q	$\overline{Q}$
L	X	X	L	H
X	H	X	L	H
X	X	L	L	H
H	L	↑	⎍	⎎
H	↓	H	⎍	⎎

Fig. 1. H = high level (steady state), L = low level (steady state), X = irrelevant, = transition from low to high level, = transition from high to low level. (a) 74121. Rint = 2k, Rext min = 1.4k, Rext max = 40k, Cext max = 1000 uF, output pulse max = 28 sec. (b) 74122. Retriggerable monostable multivibrators with clear. (c) 74123. Dual retriggerable monostable multivibrators with clear. Rext min = 5k, Rext max = 50k. (d) 74221.

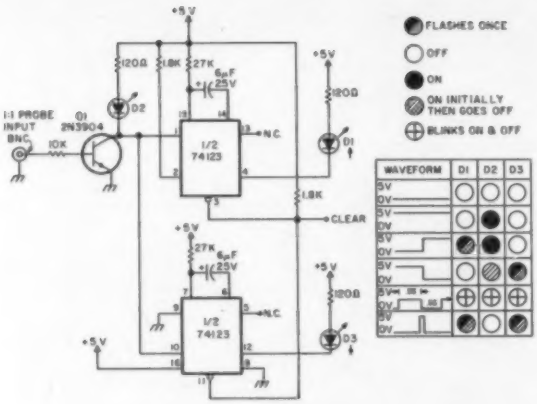


Fig. 4. A logic checker for TTL circuits.

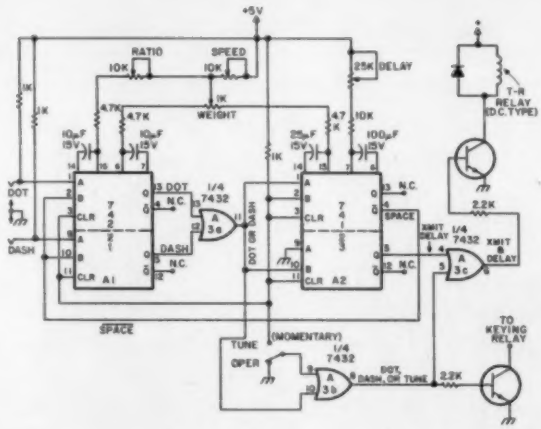


Fig. 5. An electronic keyer that provides for control of the T/R relay.

repetition rate. The Rext resistors may be made variable for more flexibility.

With a little experience in using this device, you can get a pretty good idea of how the circuit under test is performing. Of course, a scope would give an even better idea, but you get what you pay for.

The keyer of Fig. 5 looks fairly complex at first glance, but it is really only a combination of the circuits of Figs. 2 and 3. It uses only three integrated circuits and provides control of the T/R relay for break-in operation. The entire circuit was built on two experimenter boards that were purchased at the local hobby electronics store. The 74221 forms the dots or dashes. This part of the keyer works like A1 of Fig. 3, except that the paddle selects which side of the IC will put out the pulse. Pin 1 of the 74123 acts like the A input of A2 in Fig. 3, and this half of the 74123 makes the spaces between the dots or dashes. The remaining half of the 74123 and A3b and A3c are similar to the T/R switch of Fig. 2. OR gates are used here instead of a NAND gate, and the Q output of the one shot is used instead of the $\overline{Q}$ output, but the circuit is basically the same.

The information presented here should give you an idea of what one shots do and how to hook them up. If you haven't tried using ICs yet, why not get started by trying a few projects using one shots? ■

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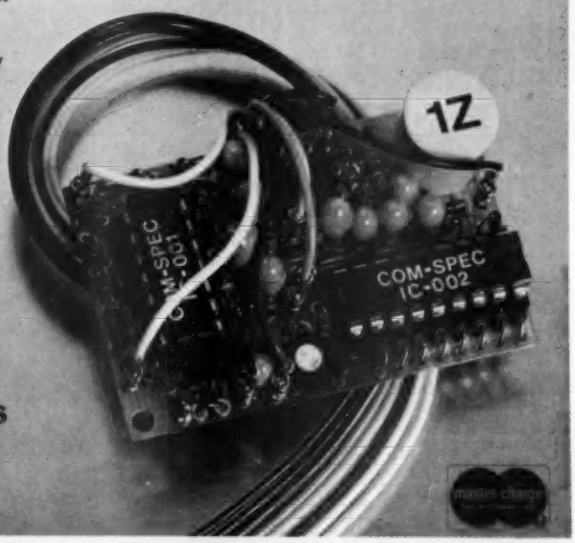

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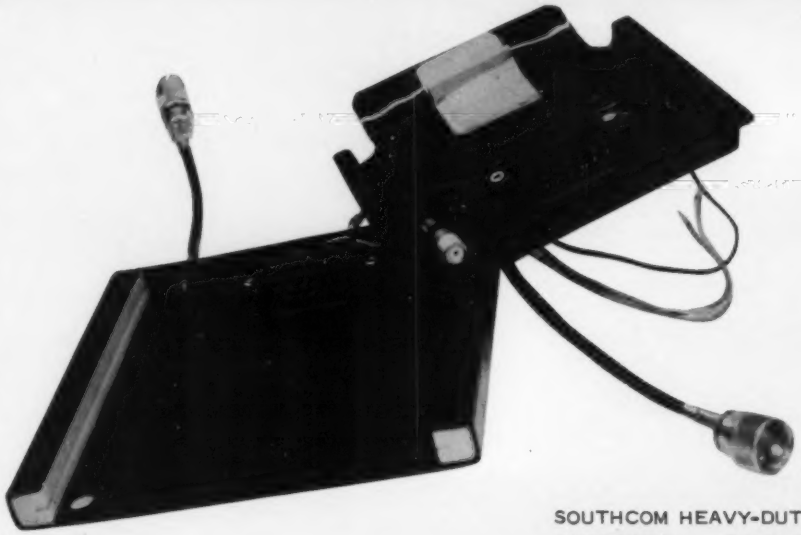

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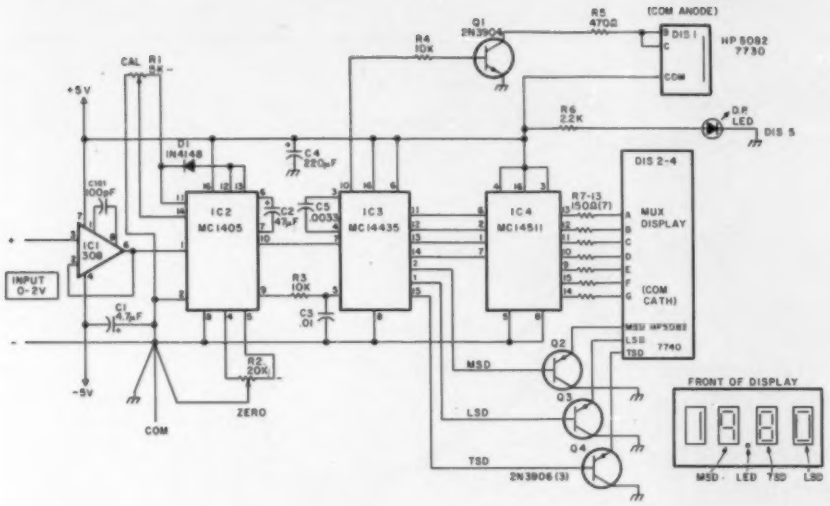

Fig. 1. Basic meter.

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DVMs Get Simpler and Simpler

- - wait'll you see the MC-1405!

With all of the interest in digital electronics, and with prices of the related parts dropping, it seems natural to me that much of the equipment in our labs and shacks could be "digitized." The result would be that equipment would be much easier to read (no analog meters to interpret) and perhaps the readings would be more accurate. This is part of the rationale I used to justify starting this project – to design a digital voltmeter so cheap and easy to build it could be included in my power supplies, communications gear, etc. It would also be nice to have a digital multimeter, too. So with that I got started.

You may be aware of the fact that many semiconductor houses offer *digital voltmeter* chip sets. These consist of an analog to digital converter chip and a digital counter array chip. All you have to add, at the most, are a power supply, a system clock, a reference source and a display system. That can easily mean six chips and up! This means high cost and lots of construction. I know because I built several voltmeters this way, and that includes a so-called "One Chip Voltmeter!" But there is a better way.

Motorola has introduced a chip set that requires only a power supply and a display system. It's easy to work with and easy to calibrate. And the best part is that it's available and cheap (under $18 for the set), too! Accuracy is rated at 0.05% and that is probably worst case! Your voltmeter accuracy will depend upon the accuracy of the standard you use. I'll show you how to build a good one. This is the system our "Cheap and Dirty DVM" is based on!

I feel I should mention some of the disadvantages of our DVM, to be fair. The first one is that it won't measure negative voltages. You have to reverse the input leads for that, like on an analog VOM. The second disadvantage is that the chip set has an input impedance of 4k Ohms, but this is changed to 10 megohms input with a $2.00 op amp in our unit. None of these problems are serious – the first requires a quad op amp and some parts. The second has already been taken care of. I'll discuss the solution to the polarity problem in a future article *and* show you how to measure ac volts and Ohms at the same time. If you want to read further about the Motorola chip set, call or write them for the data sheets and ap notes listed at the end of this article.

Construction isn't too difficult, but there are several areas to watch. Probably the biggest problem you will have is finding a box to house the finished unit. If you want a general purpose meter to be used around the shack, a minibox will work fine. However, if you are like me and want to build a digital panel meter to be installed permanently in a piece of equipment, you are in a sticky situation, as digital panel meter cases are very hard to get! I finally found a few in surplus, but I can't get enough to share the wealth. Let me suggest you use a small minibox if you're stuck. Cut a rectangular hole in the

front of the box and put a red filter behind it. Then cut and bend aluminum stock into two L brackets, large enough to fit on the ends of the box. You could then cut a hole large enough to accommodate the box front in your panel and use the L brackets to secure it. A possibly better way would be to make up an aluminum plate larger than the front of the box and use it to secure the box to the panel. You would have to duplicate the display cutout in the plate, of course, but the result could look pretty neat!

If you have never built a digital voltmeter before, you are in for some interesting construction! If you have, the construction hints I am about to give will sound familiar. The layout isn't too critical, and the parts may be placed nearly anywhere. However, I would like to suggest that the heat generating power supply be located as far away as possible from the MC-1405 chip. In fact, try to get it in a separate module. The layout for one of my digital panel meters, despite the close proximity of the power supply components, hasn't caused any problems, but you never know. Why the caution? Heat may cause drift of calibration if it is great enough. By the way, this circuit draws around 100 mA from the +5 volt line. Also, when you wire up the LM-308 and the MC-1405 circuitry, the grounds are critical. Improper grounding causes calibration errors, drift, and other problems. You'll notice how all grounds come together at one point on the schematic; this is the way to wire your unit! Remember that this voltmeter can be a laboratory quality instrument if you follow my simple precautions.

I built up six different units and I built them pretty much alike. First, I assembled the display board. Three HP 5082-7740 LED readouts were used for the multiplexed part, and an HP 5082-7730 readout was used for the 1 on the display. Note that the 7740 readouts are *common cathode* and the 7730 is *common anode*. You could use all 7740s if you wish. Or even Data Lit 704s; you name it in common cathode! A separate LED was used for the decimal point; this makes for easier reading at a distance. The three 7740s were wired up for multiplex operation; this means that all A segments were wired together, all Bs and so on. Homemade L brackets were used to attach the completed display to the rest of the electronics board.

Photos by Roger Wilcox

The next part of this project is to get the electronics built and running. Fig. 1 shows the schematic of the basic meter. This is the circuitry that is recommended by Motorola for their chip set, so you'll find it well described in their ap notes and bulletins. The illustrations show one of my first meters – a panel meter in a power supply. Both the schematic and the illustrations should help you get your unit built and on the air, pronto!

I built my first units on scraps of copperclad perfboard, known as "ground plane" board. This method of construction works fairly well, because the grounds are very easy to make, but extra time is required to drill out the copper from holes where parts are going to be mounted. Regular perfboard works fine, though, and you are welcome to use this method. It's also cheaper and you don't have to worry about shorting IC pins to a copper ground plane. I started building my units by installing the IC sockets and wiring up the grounds. On the non-ground plane boards, I brought the grounds from all ICs to one point – pin 8 on IC2. The #24 bare wire I used for all connections worked just fine. Then with the hard part over, I wired up the rest of the unit. Note that the pin numbers on IC1 are for the TO-5 can. If you use the DIP version of the LM-308, you have to look up the new numbers. The driver transistors, Q1 through Q4, are not critical. Almost any silicon NPN unit with a beta of 100 or better will work for Q1. And any silicon PNP units with betas of 100 and up will work for Q2 through Q4. I suggest 2N3904 and 2N3906 because they have given me the most consistently good results. If you can't easily buy the ICs, try Circuit Specialists, PO Box 3047, Scottsdale AZ 85257. They can help. The MC1405L is $8.95, and the MC14435VP is only $7.95. The LM308 is available from Radio Shack. Yes, the parts are available for this project!

As you finish up the electronics board, I would like to make a comment about the pots you use for R1 and R2. Don't try to squeeze by through subbing single turn pots. They will be very hard to adjust and you probably

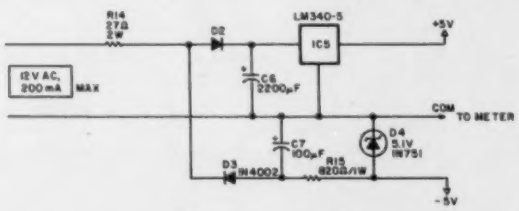


Fig. 2. Power supply.

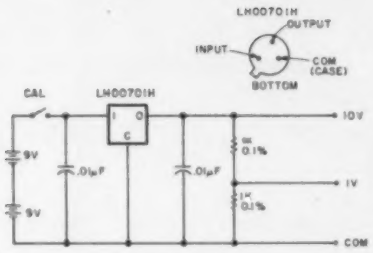


Fig. 3. Calibrator.

won't be able to calibrate. Always use 10 turn wire wound units, or better yet, 20 turn units if you have the space. I found mine for 50 cents each at Poly Paks. The exact resistance values aren't especially critical, so you can sub pots fairly easily. Another thing you can do with the pots is to "remote" them by mounting them off the electronics board and attaching them with wires. You'll notice that I went this route with the unit in the photos. Be safe and bring out separate ground wires for each pot. As before with the other wiring, terminate them at pin 8 of IC2. I finished up by attaching the display board to the electronics board with homemade L brackets on my units. Use resistors R7 through R13 to attach the display segments to IC4 and save yourself some wire.

You may need a power supply. You'll need plus 5 volts at about 100 mA, and minus 5 volts at about 10 mA. You might be able to borrow these voltages from other equipment if they are regulated. If not, build the optional power supply shown in Fig. 2, and power your voltmeter from a 12 volt filament transformer. I did this with the unit shown; one of the power supply's internal transformers had an extra 12 volt, 250 mA winding, so I used it. You could also use one of those line plug transformers used for calculators, if you open the case and remove the diodes that are usually there.

You might want to add a range switch to the input of your new meter, or perhaps just change ranges. As built, it measures 0 to 2 volts. Fig. 4 shows some ideas for attenuators, both simple and deluxe. I built the simple one into the power supply voltmeter. I needed a 0 to 20 volt meter, so I made a x10 divider. R_B was 10k, 1%, and R_A was 100k, 1%. Ideally, these resistors should add up to 10 meg, the standard digital voltmeter input resistance, but in a power supply, these resistances aren't critical (no loading problem!). Also, I had these values! You can use whatever precision resistors you have for x10, x100, or even x1000 dividers. If you don't need a divider at all, connect a 10 megohm resistor across the voltmeter input to cut zero drift when the test leads are open. The deluxe divider shown is what you would use in a digital multimeter. It features 10 megohms input resistance and overload protection. For best results use 0.1% resistors throughout. You will also want some kind of decimal point switching on the display; that will mean another deck on the range switch and two more LED/dropping resistor combinations.

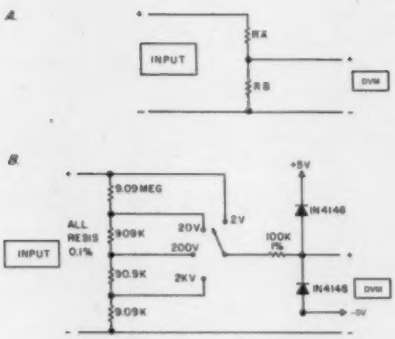
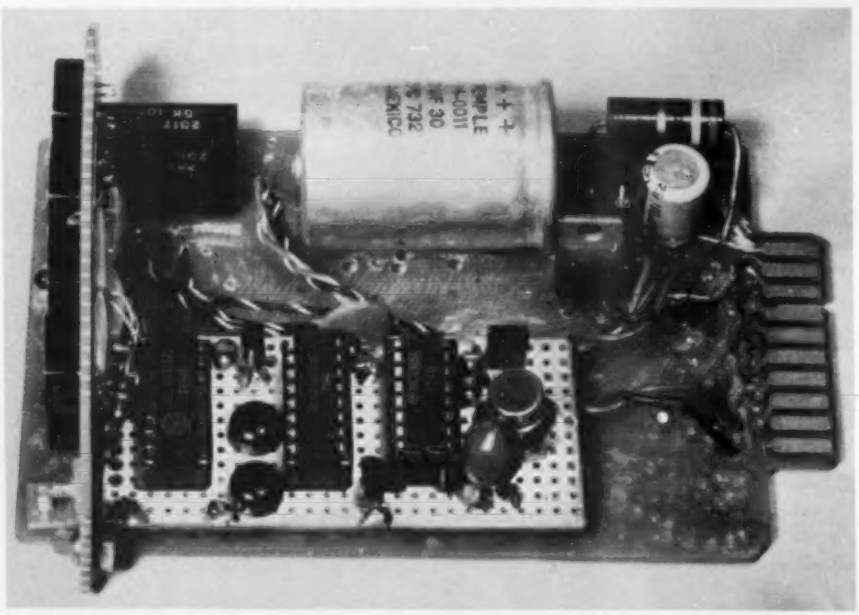


Fig. 4. Input attenuators, simple (a) and deluxe (b).

Calibration is quick and easy once you are set up. Beg, borrow or ? a dc voltmeter calibrator that is at least 0.01% accurate. Or, lacking that, you can build the calibrator shown in Fig. 3. It is designed around the National LH0070IH 0.01% 10 volt reference, which sells for about $5.00. Circuit Specialists might be able to get one for you. Power is supplied by two 9 volt batteries. Lacking this calibrator, you can either calibrate your voltmeter against another DVM, or (shudder) with a 1.34 volt mercury battery. The battery is a last resort, because you might be able to get only about 1% accuracy or so, depending upon the condition of the battery (it should be fresh and unused).

With that out of the way, connect up the voltmeter and apply power. Let it settle down for about 20 minutes or so and then short the input leads together. Adjust the zero pot, R2, for a 000 reading. You'll see the meter read something like 087 – 093 – 097 – 098 – 099 – 000 – 001 – 002 if all's well.

Once the zero is adjusted, apply either +2.000 volts



from the commercial calibrator (preferred) or +1.000 volts from our calibrator. This is assuming you have the basic 0 to 2 volt unit; for other units increase the input voltage by x10, x100 or whatever. Then tweak R1, the calibration pot, for a 1.999 to .000 reading (or 1.000 with a 1 volt calibrator). Go back and short the input leads to check the zero; if it is necessary to adjust zero, recheck the calibration, too. These adjustments interact somewhat.

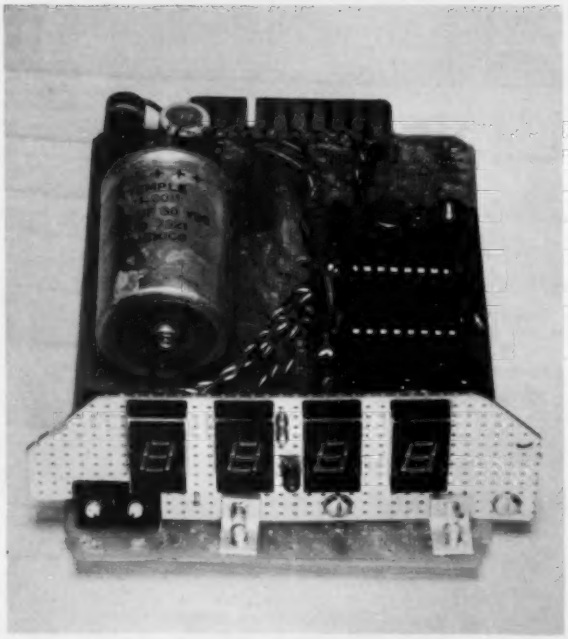
I hope you like your new "Cheap and Dirty Digital Voltmeter." It really adds a touch of class to have equipment in the shack with digital readouts. The price is right, too; you probably spent about ¼ as much for your meter as you would have for a commercial unit! ■

References

Motorola AN-748, "Applications of MC1405/MC14435 in Digital Meters."
Motorola EB-55, "A Battery Powered 3½ Digit Multimeter."
Motorola EB-35, "Autopolarity Circuits for the MC1405 Dual Slope A/D Converter System."
Motorola MC1405L Data Sheet.
Motorola MC14435VP Data Sheet.

Parts List

C1 – 4.7 uF, 10 volt electrolytic cap
C101 – 100 pF disc cap
C2 – 47 uF, 10 volt tantalum or electrolytic cap
C3 – 0.01 uF disc cap
C4 – 220 uF, 10 volt electrolytic cap
C5 – 0.0033 uF disc cap
C6 – 2200 uF, 25 volt electrolytic cap
C7 – 100 uF, 25 volt electrolytic cap
D1 – 1N4148 diode
D2, D3 – 1N4002 diode
D4 – 1N751 zener diode, 5.1 volts
IC1 – LM308 Radio Shack
IC2 – MC1405L Circuit Specialists
IC3 – MC14435VP Circuit Specialists
IC4 – MC14511P Circuit Specialists
IC5 – LM340-5 Circuit Specialists
Q1 – 2N3904 transistor
Q2-Q4 – 2N3904 transistor
R1 – 5k trimmer
R2 – 20k trimmer
R3 – 10k resistor



R4 – 10k resistor
R5 – 470 Ohm resistor
R6 – 2.2k resistor
R7-R13 – 150 Ohm resistor
R14 – 27 Ohm, 2 Watt resistor
R15 – 820 Ohm, ½ Watt resistor
All resistors ¼ Watt unless noted

DIS 1 – HP 5082-7730 Common Anode Display
DIS 2 to DIS 4 – HP 5082-7740 Common Cathode Displays
DIS 5 Man 5024 LED
Misc: Case for meter, perfboard, assorted wire, etc.

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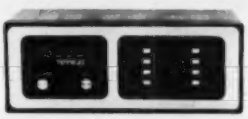

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Instant PC Boards

- - using new Color-Key technique

More people would make printed circuit boards by the photographic method if they weren't discouraged by the chemical processes and darkroom requirements that are necessary to produce a film negative from their positive artwork master. Although I have a complete darkroom setup for developing and printing black and white and color film, I have never actually used a photographic film for making printed circuit negatives because there is a material called Color-Key that is far more convenient to use and does not require the array of chemicals, trays and accessories demanded by photographic film.

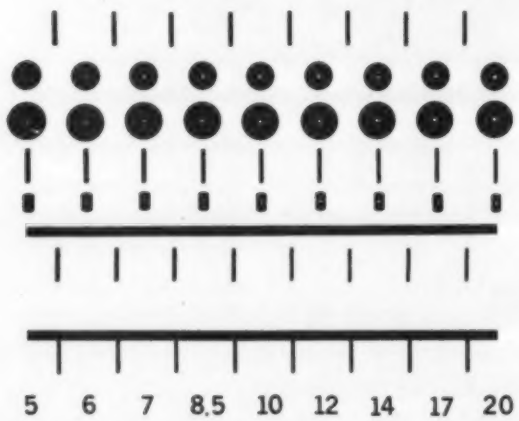

Fig. 1. Color-Key exposure test artwork.

While a darkened area is necessary during the time the positive artwork and the Color-Key negative material are placed together in some type of holder before the exposure, it doesn't have to be a darkroom. It can be any room or closet lighted by subdued artificial light. A sunlit room cannot be used as the Color-Key material is sensitive to ultraviolet radiation.

After exposure, the Color-Key material needs only to be developed to make an excellent printed circuit negative. The developing step is very simple and doesn't even require a tray, just a flat surface to lay the material on while applying the liquid developer to the sensitized side. No trays, shortstop, fixer or temperature control; you even work in normal room light. After development, just hold the negative under the cold water faucet for a few seconds to wash away the residue and hang the negative up to dry.

Color-Key contact imaging material, as the manufacturer identifies it, is a product of 3-M. It is supplied in several colors and as a negative material or as a direct positive material. It is sold in boxes of 25 sheets and the smallest size is 8½ by 11 inches. I have been purchasing it from a large photographic supply store. It's also available at some art and drafting supply stores as it is used in the preparation of ads by some advertising agencies.

I have been using the type identified as black opaque negative acting material. When exposed and developed, it gives a solid black and clear transparent image, just what is needed for printing a sensitized board.

The developer for Color-Key material is sold in ready-to-use liquid form. It is identified as negative acting developer for Color-Key material. A quart of developer is sufficient to develop a box of 25 sheets of the 8½ by 11 inch size.

As the name suggests, the material is intended for contact printing; that is, the positive artwork is placed in contact with the material during the exposure. Ultraviolet radiation must be used for exposure, in the same manner that sensitized printed circuit boards are exposed. Direct sunlight is a source of ultraviolet radiation, but a more practical source for making negatives (and PC boards) is an ultraviolet lamp. While the same exposure setup can be used for printing negatives and boards, the exposure time is

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not necessarily the same for each.

I have been using a small 15 Watt ultraviolet fluorescent tube which I bought complete with fixture for less than $20 for exposing negatives and boards. The lamps and fixtures are sold at large self-service hardware and variety stores.

I use an 8 by 10 inch photographic contact proof printer to hold the positive artwork in contact with the Color-Key material during the exposure. Lacking a contact printer, a small piece of window glass from the hardware store could be used to weight down the positive and negative material. The Color-Key material has a natural curl so it must be flattened during the exposure.

The sheets of Color-Key material can be cut to match the size of the artwork before making the exposure. You can work in a fair amount of artificial light without exposing the Color-Key. I have a bare 15 Watt bulb plugged into an outlet about 3 feet away while cutting the material and placing the negative material and the artwork positive in the contact printer. Once the contact printer is loaded, I turn on a 60 Watt overhead fixture which remains on during the exposure and development steps.

Like photographic film, the Color-Key material has a shiny and a dull side. The dull side contains the sensitive material while the shiny side is the transparent base. Exposure is made through the shiny side, which requires the dull side to be placed down in the contact printer and the artwork positive placed right side up over the Color-Key material in contact with the shiny side.

When the exposure is completed, the Color-Key material is ready for its single processing step, development. Unlike film which is soaked in a tray of developer for a specific time, Color-Key material is developed by laying it on a flat surface, dull side up, and rubbing a small amount of the liquid developer over it until the image is formed. The black material that is removed to form the image comes off very quickly in the form of a sludge.

I use a piece of window glass about 14 by 20 inches for the flat surface. The exposed material is placed dull side up on the glass and a small amount of developer is poured over the negative. The natural curl of the material aids in keeping the developer from running off the negative. The instructions suggest the use of special pad and pad holder to rub the developer over the negative, but a piece of facial tissue works very well and costs much less. The developer is rubbed over the dull side with the tissue until the image is complete. This takes only a few seconds and since the overhead light is on during development, the image can be seen forming as the black is removed. When the image is complete, the negative is washed under cold running water for a few seconds to remove the residue and then hung up to dry.

Rubbing too hard or too long will remove some black material from areas where it should remain. You can avoid rubbing to excess with a little care, since with the light on you can see the image appearing. If an area doesn't seem to respond to development, add a little developer liquid instead of rubbing harder.

It is possible to develop the negative so quickly that the first rub with the tissue will reveal the image. I run hot water from the faucet over the glass developer plate for several minutes while the exposure is finishing, stopping the hot water a minute before the exposure is completed. The glass plate is placed on several folded newspapers to retain the heat. The warm glass plate under the negative activates the developer so much that development takes place before you can pick up the tissue and begin to rub. Developing the Color-Key on a warm plate seems to produce better negatives as the black material left on to form the image appears to be bonded to the base much more tightly than when the development is accomplished at room temperature. The developer itself should not be heated as it may exhaust itself, although it may be warmed slightly if it has been stored in a cold location.

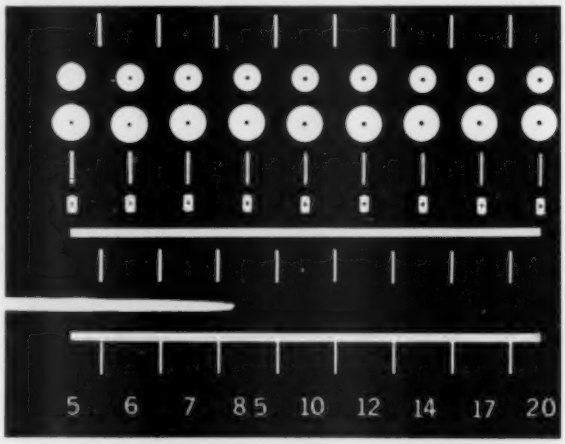


Fig. 2. Color-Key exposure test negative.

Exposure time for each ultraviolet lamp and film holder has to be determined by test. Exposure depends on the amount of ultraviolet radiated by the lamp, the distance the radiation has to travel to reach the sensitized material and the attenuation of the glass in the contact printer or film holder. My ultraviolet lamp is positioned 8 inches above the glass in the contact printer and my exposure time is 14 minutes. Lowering the lamp would reduce the exposure time, but could cause the exposure to be insufficient at the edges of large pieces of the negative material as the rays have to travel a greater distance from the lamp to reach the edge than to the center of the contact printer. If I felt a need to shorten the exposure time, I would add a second lamp as the most practical way to do it.

Finding an exposure time that will work satisfactorily is fairly simple. It can be done by using a test positive that has been made to aid in determining the correct exposure time. Since our prime use for the Color-Key material is to make printed circuit board negatives, I made a test positive using printed circuit decals for solder pads, lines and IC pads. Fig. 1 is the test positive I used to determine exposure time for the Color-Key material in my exposure setup.

The test positive is divided into nine sections as identified by the numbers at the bottom. The number 20 at the far right means that section will be exposed for 20 minutes. The four items in the section above the number 20, an IC pad, a short thin line and two solder pads, are the items to be exposed and examined on the negative to determine the exposure time for Color-Key negatives.

Each numbered section contains the same four items, and the section number is the time in minutes the section should be exposed to ultraviolet radiation. After exposing and developing the negative, the section which shows the best reproduction of the items will be selected as having the correct exposure time. The various lines separating the sections are

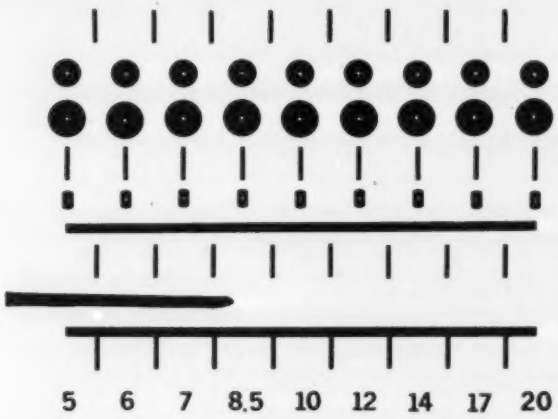


Fig. 3. Color-Key positive made from test negative.

guidelines for exposing the negative and cannot be used for evaluation of the negative.

Exposure is made by placing a piece of Color-Key material and the test positive in the contact printer or film holder that will always be used for making Color-Key negatives and placing a piece of dark paper or cardboard on the contact printer so it covers the sections that have received their allocated exposure.

To begin, place the cardboard over the section numbers at the bottom, leaving all the sections uncovered, and place the contact printer under the ultraviolet source. After a 5 minute exposure, remove the cardboard from over the section numbers and use it to cover the section marked 5. The numbers at the bottom and sections 6 through 20 should be exposed for 1 minute. Note that the bottom numbers are not covered again after the 5 minute exposure. They are to receive all subsequent exposures. After the 1 minute exposure, slide the cardboard to the right to cover section 6, leaving section 5 covered. After a 1 minute exposure of sections 7 through 20, move the cardboard to cover section 7. Expose sections 8.5 through 20 to the ultraviolet radiation for 1.5 minutes. The slide the cardboard to the right to cover section 8.5 and expose sections 10 through 20 for 1.5 minutes. After 1.5 minutes, move the cardboard to cover section 10, keeping the previously exposed sections covered and expose sections 12 through 20 for 2 minutes. Then cover section 12 and expose sections 14 through 20 for 2 minutes. Slide the cardboard to the right and cover section 14. Expose sections 17 and 20 for three minutes. Slide the cardboard over section 17 and expose section 20 for three minutes.

When the test exposure is completed, each section of the negative will have received a total exposure in minutes equal to the number of the section and the numbers at the bottom will have been exposed for 15 minutes. While performing the exposures it is not necessary to turn the ultraviolet lamp on and off. The cardboard can be repositioned in less than a second and the resulting exposures will probably be more accurate than if you try to control the radiation by switching it on and off. Be sure your cardboard is large enough to cover sections 5 through 17, that it will not be obstructed by nearby objects and that you use a small weight to hold it in position if it extends past the edge of your film holder or contact printer.

After developing the negative, each section should be carefully examined to determine the best exposure time. My test negative, Fig. 2, shows that it was badly underexposed at 5 minutes. The dot is missing in the small solder pad, the other pad dots are too small and some of the black near the large pad came off because of the underexposure. Fig. 3 is a positive made from the test negative and perhaps may be more easily read. Sections 6 and 7 are better but are still underexposed as the holes in the pads are undersized. This shows very clearly in the IC pads. Section 8.5 is much better, while sections 10 through 17 look very good. Section 20 is overexposed, as can be seen by the slight enlargement of the pad holes. This is more easily seen in Fig. 2, the negative, as overexposure is easier to determine by noting an increase in the size of dots.

The clear strip that begins at the left edge of the negative and runs through section 10 was caused by the edge of the cardboard used for masking off the sections and should not be considered in evaluating the negative.

Fourteen minutes was chosen as the correct exposure time, as that results in a negative where the subjects are the identical size as on the positive. While this is difficult to see from examining the figures with this article, you will find when you make your own test negative the easiest way to evaluate the results is to place the test positive over the developed negative and align the items in each section. You will discover that the underexposed negative subjects are larger than the positive ones, as the positive items will not completely cover the negative subjects in the sections that were underexposed. In the overexposed sections, the reverse is true. The subjects on the positive are larger than their negative images in the overexposed sections. The closest size match between positive and negative images is in the section that has received the most nearly correct exposure to the ultraviolet radiation.

The positive in Fig. 3 was made by exposing the test negative for 14 minutes. This has always been about the correct exposure time for my untraviolet lamp and contact printer when spaced 8 inches apart. These exposures were made recently and duplicate the results of the test I made four years ago when I began using Color-Key material. Apparently the ultraviolet radiation from my lamp hasn't changed after several hundred hours of use.

If your first test negative is completely under- or overexposed, multiply the exposure time for each section by 2 if underexposed or by 0.5 if it was overexposed and print a second negative.

If your exposure time is much longer than anticipated, the problem could be the glass used in the contact printer or film holder. Some types of glass block out ultraviolet radiation fairly effectively. The glass in my contact printer is ordinary plate glass, as I had to replace the original glass which shattered from the heat of a 500 Watt bulb, my first source of ultraviolet.

While practically any source of ultraviolet radiation also emits some visible light, the amount of ultraviolet cannot be judged by the quantity of visible light. Ultraviolet radiations are not visible and can be harmful in large doses. You can be "sunburned" by large amounts or even have your eyes affected just as can happen by excessive exposure to the sun. The ultraviolet radiation from the sun causes the sunburn. The 15 Watt fluorescent lamp should cause no problems, but if one is tempted to obtain a more powerful source of ultraviolet radiation, he should also buy a pair of goggles specifically designed to block ultraviolet radiation.■

by Wayne Green W2NSD/1

I/O EDITORIAL

GETTING STARTED

The chances are that you may be thinking about maybe getting a microcomputer. With many of them appearing to be in the $300 to $500 price bracket, it isn't something where you are going to send away a check blindly. And you're probably still asking a lot of questions about what you are going to be able to do with it if you do get it.

There are a discouraging number of alternatives, so perhaps if I lay down some guidelines it will help. I'd make specific recommendations, but that would upset some manufacturers . . . and let us not ignore them as is paying the bills for the magazine.

The heart of a computer these days is the chip of your choice: 8080, 6800, 6502, Z-80, etc. This is nestled in the central processing unit (CPU). Each chip has its clique and there are enough pros and cons for each to bring on a fistfight in the most peaceful of computer clubs. The proponents of the Z-80 have some persuasive arguments, since it is a sort of super 8080 contraption, with some of the charm of the 6800 thrown in to confuse Motorola fans. Having given you little real help with this aspect of your system (the key to the whole thing), we can pass on to less substantive matters.

In addition to the CPU, you'll be needing a good sturdy power supply and a nice cabinet. None of the manufacturers have yet caught on to the Star Trek type of computer . . . the one with the thousands of flashing lights and brilliant colors . . . and we all know way down in our subconscious that any real computer is going to look like that. Who wants a box with a switch and pilot light on the front? That's not a computer!

Now, about that power supply. You'll either start out with a heavy duty supply or you will rue the day and end up modifying it or adding more supplies later on. A little research will give you a good general idea of how much power you are going to need. Figure on a CPU, at least 16K of memory, a couple I/O boards, a PROM board, character and graphics generators, etc. Once you've added up the current needs of all that, you might as well double it, because you will hardly ever be cutting down on your system . . . there will always be some new and exciting gadget which will plug in to let you do something else . . . it might be generating full color art . . . writing music . . . some special games such as Tank . . . you don't know what. Looking up the specifications for the many boards available (over 150 are now designed for the Altair Bus) will help you get familiar with this new world.

Memory. It's expensive and you're going to want to buy as little as you can to save money . . . and as much as you can afford to make your system work better. Your presently available systems will generally support a maximum of 64K of memory. I doubt if your pocket will. Mine doesn't. You can't get along with much less than 12K since most of the BASICs take 8K of that and need some elbow room to be used. There are some Tiny BASICs which only use 4K, but I doubt if you will be satisfied with the restrictions of Tiny for long.

You'll need input/output (I/O) boards to permit you to communicate with the CPU. You get into a lot of complication with these things with serial vs parallel, baud rates, parity bits, and all that other stuff which you'll eventually learn via articles in the magazines. You can hook a lot of different things into your system . . . a Teletype, a CRT (also known as a television typewriter, TVT, or video display terminal, VDT, or just plain "tube"), a cassette recorder, a paper tape system, magnetic tape . . . etc.

You should be aware that all of the Teletype compatible I/O boards are 20 mA systems which are designed to match the ASR-33 and 35, and these machines start around $800 or so. That Teletype you have in the shack is probably a Model 15 or 19 and it needs 60 mA to operate, so you'll have to build an interface between the two. Your machine speaks Baudot code and the I/O talks only ASCII, so you need a converter for that . . . or a program in lieu of the hardware. It probably won't be long until there is a Baudot I/O board for 60 mA machines available, but I haven't seen one yet.

The VDT is probably the handiest way of communicating with your computer. The selection of these available is very limited so far . . . with the Southwest Tech CT-1024 being the most used. This comes in kit form (it is fun to build) and requires you to use a black and white television set for the display. Since TV sets are selling for under $100 brand new these days, it is a reasonable path. The HAL keyboard and character generator also use a TV set. Many of the surplus keyboards are fine, but be wary of some of the complete VDTs in surplus . . . some of them take a lot of know-how to convert and I've been unable to get much in the way of articles on them so far.

Once you have your CPU, the power supply, a beautiful cabinet, a VDT, and plenty of memory, you are ready for the big leagues. Your system will be capable of doing an amazing number of things . . . like keeping the log, keeping track of OSCAR, translating CW or RTTY, playing a hundred or so games, running many business programs, etc. Note that I said "capable." The fact is more like it will be a fantastic coffee table conversation piece until you get software. There are few other instances where a hobbyist is able to spend so much money and time and end up with something which is in perfect working order and still is totally unusable.

If you've invested in a CPU on the basis of hype and color pictures, you could join a not insubstantial group of hobbyists way up at the end of a very familiar creek. There are some people who live and breathe to program computers. It is unlikely that you are one of these . . . or even know one. This cat does not even get close to such as us, and if he did, we wouldn't be able to talk with him. All too late many hobbyists have begun to realize that all that bunk about hardware only being half of a computer may have some basis in fact. Don't say I didn't warn you.

Okay . . . programs. How do we get programs? Firstly, you make sure that the system you are going into has software available . . . and available where you can get it. You'll want to be sure they have BASIC on hand, and while Tiny BASIC is a lot of fun, this will limit you in the number of published programs you can get running. Make sure you will be getting an 8K or better BASIC. If you have that, you will be able to use programs published in books and hobby computer magazines to go the rest of the route.

Eventually there will be other languages available . . . FORTRAN is certain to come soon. In the meanwhile, you'll soon get used to BASIC and enjoy writing many of your own programs. Without a language such as BASIC, you are stuck with machine language . . . which is no language at all. With this you have to put in every single step of the program in binary. Some experienced computerists may love machine language; however, I suspect that this is a love which requires considerable cultivation . . . and not a little masochism.

A little while back I briefly mentioned cassettes. I was covering up a lot of confusion with vagueness in the process. The fact is that the microcomputer industry definitely does not have its . . . er . . . act together when it comes to cassette systems. If you want to get a heated argument going, just walk up to a group of computerists and say you think such and such a cassette system is best . . . and stand back. You can fill in the blank with Tarbell, Kansas City, Mits, Digital Group, National Multiplex, etc. They're all different and all have *something* in their favor. Your best bet, for the time being, is to go with whatever system the CPU manufacturer likes at the moment and figure that you're going to have to change before long.

There is much to be said for going with the most popular systems. Along this route you'll find more help from fellow sufferers . . . more peripherals . . . more options . . . more articles . . . and a whole lot more programs.

So what's the most popular system? No one in the industry is giving out any sales figures, but I've looked carefully into my crystal ball and I think it works out about like this . . . at least for the hobby computer market . . .

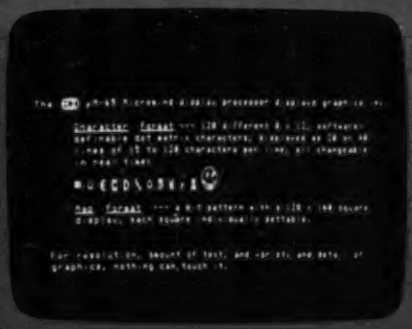
System	*My Guess*
Altair 8080	2650
Imsai 8080	1025
Other 8080 type	515
Z-80 type	525
8008 type	550
Southwest Tech 6800	600
Sphere 6800	140
Other 6800 type	600
OSI 6502	230
Kim I 6502	450
All other hobby systems	1825

Yes, I realize that the total comes to a bit over 9,000 hobby systems, but that's what I see out there. You can bet I'll be running polls in *KB* to keep tabs on what systems are selling and what peripherals are being used with them. The above does not include the microcomputer systems which have been sold to firms for later resale . . . called original equipment manufacturer (OEM) sales.

Since we're projecting a readership of about 35,000 for the third issue of *Kilobaud*, it is obvious that the great percentage of computer hobbyists have yet to buy hardware. I doubt if they would be subscribing to *KB* if they weren't serious enough about computers to want their own, so we're looking at a considerable market among the *KB* readers for hardware. This is probably one of the best times in history for the entrepreneur to put a product on the market and build up a company . . . but I digress, as usual.

Why do I keep hearing you mumbling about cost? This is a *hobby* . . . like sports cars . . . flying . . . blondes . . . and, as you know, the difference between a man and a boy is the price of his toy. You can add up all the components for yourself, but it is unlikely that you are going to have much going for under $2000. I counted up the claimed investments in hobby computing of about five hundred subscribers to *KB* and it

Continued on page 160



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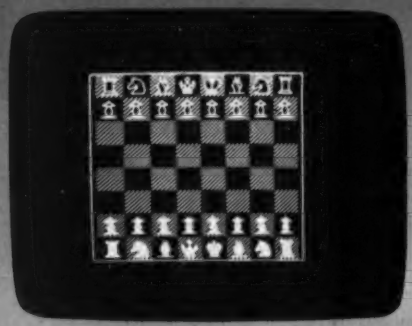

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System software—including ECD's own notsoBASIC high level language, on advanced error-correcting tape cassettes—provides a word processing editor, a powerful assembler, a debugger, a file system, graphic routines, and peripheral handlers. We also include dynamic graphic games: Animated Spacewar and Life.

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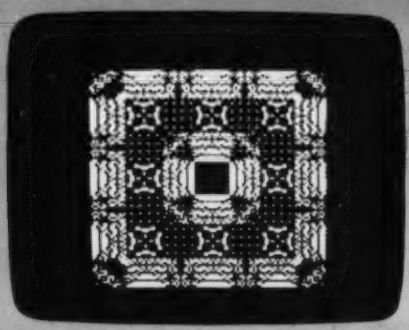

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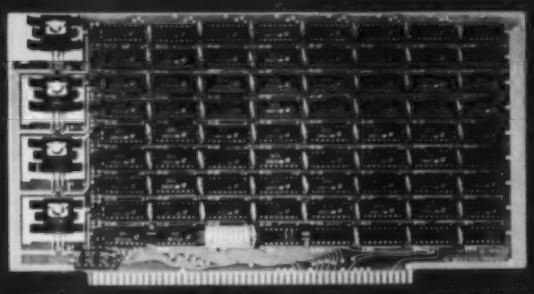

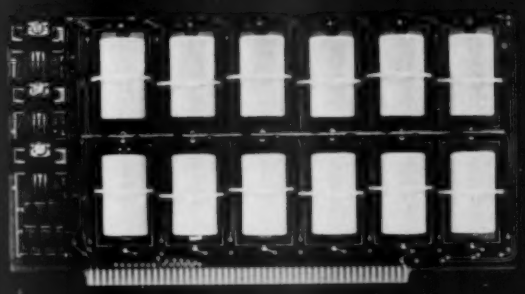

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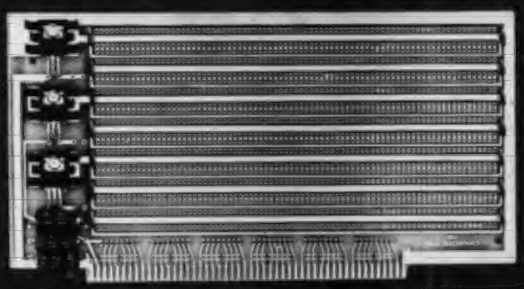

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Satellite tracking — a subject that I would think could get pretty sticky for us non-whiz-kid math types. Bob Henson presents the subject in such a manner that the math seems almost incidental (i.e., he doesn't get bogged down in the details like many authors would have a tendency to do). Another neat feature of his article is the fact he offers some suggestions for modifying his BASIC program so that it can be rewritten and run on other BASIC interpreters. — John Craig.

Computerized Satellite Tracking

- - the needed software

Bob Henson WB0JHS
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To date, several articles have appeared in ham publications describing graphical techniques for calculating antenna aiming data for amateur and weather satellites. While these methods provide results that are accurate enough for most satellite communications purposes, the inconvenience involved in the preparation of the necessary charts and graphs is not particularly appealing, leaving one with the notion that there must be a better way. Those particularly adverse to the graphical approach will inevitably look to the application of the digital computer to relieve them of these computational chores. Formerly limited to a fortunate few who had access to large, expensive computers, the advent of the microprocessor and subsequent development of low cost hobby computer systems have put the computerized approach to satellite tracking within the reach of many.

Even with the computer hardware now available at an affordable price, one necessary element is still missing: namely, the software, or program, to perform the calculations. This article will describe such a program. While the intent is to provide sufficient background information so that the reader can modify and execute the program on any computer in any language that he might have available, a listing of a version written in BASIC will be presented, since it appears to be the current "standard" with hobbyist systems.

Without attempting any rigorous mathematical derivations, equations necessary to afford a solution will be presented. If desired, more detailed information on these equations can be gleaned from the references listed at the end of the article and from the many handbooks and textbooks dealing with spherical trigonometry. Since the program to be described is a minimal operating configuration, performing only the most basic tasks required by a tracking program, suggestions for extensions, modifications, and enhancements will be presented at the conclusion of the article.

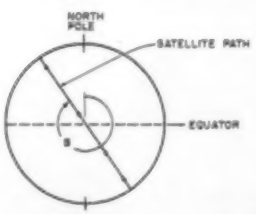

Fig. 1. Bearing of the satellite sub-point path at EQX (represented by the angle B).

Background

Several excellent articles have been published presenting the fundamental concepts of satellite tracking. Rather than reiterate the information in those articles, I will instead summarize only those orbital characteristics with which we need concern ourselves in developing a satellite tracking program. Those who need a "refresher" are urged to read the articles referenced at the end of this article.

To begin with, let's define the information that we want the program to calculate for us:

1) The time of each EQX (northbound equatorial crossing by the satellite sub-point). Satellite sub-point — the point on the Earth's surface that would be intersected by a line connecting the center of the Earth and the satellite.
2) The longitude of each EQX.
3) The azimuth (degrees clockwise from true North) of the satellite position with respect to the station

Elapsed Time (minutes)	Latitude (degrees)	Longitude (degrees)
0	0.0	0.0
2	6.13	1.79
4	12.26	3.60
6	18.38	5.48
8	24.49	7.46
10	30.59	9.57
12	36.66	11.93
14	42.70	14.59
16	48.69	17.72
18	54.61	21.52
20	60.40	26.43
22	65.98	33.33
24	71.15	43.51
26	75.48	60.03
28	78.02	85.82
30	77.60	116.25
32	74.46	139.48
34	69.84	153.92
36	64.53	163.05
38	58.89	169.33
40	53.06	173.94
42	47.12	177.54
44	41.11	180.51
46	35.07	183.12
48	28.99	185.40
50	22.89	187.48
52	16.77	189.40
54	10.65	191.27
56	4.52	193.07
58	-1.62	194.19

Table 1. Latitude and longitude of OSCAR 7 at two minute intervals after an EQX at 0 degrees longitude.

versus elapsed time from EQX.

4) The elevation (degrees above the horizon) of the satellite position with respect to the station versus elapsed time from EQX.

5) The distance in statute miles between the station and the satellite versus elapsed time from EQX.

The orbital parameters of the satellite that we need to know in order to calculate this information is:

1) The altitude at which the satellite orbits above the Earth's surface. For OSCAR 7, this is approximately 910 statute miles.

2) The satellite orbital period in minutes (the number of minutes it takes the satellite to make one complete orbit about the Earth). For OSCAR 7, the orbital period is 114.9458 minutes.

3) The bearing of the satellite sub-point path at EQX (see Fig. 1). For OSCAR 7, this bearing is 348.23 degrees.

4) The difference, in degrees of longitude, of the satellite sub-point at consecutive EQXs. Each EQX of OSCAR 7 is 28.73625 degrees west of the previous EQX.

5) The time of the EQX of a reference orbit of the satellite. This can be obtained from reference data available from AMSAT or from one of the ham publications.

While most of the examples presented will be based on the orbital parameters of OSCAR 7, the program will be developed for general use for tracking satellites with the following orbital characteristics:

1) Constant orbital height (circular orbital pattern).

2) Constant orbital velocity.

3) Non-synchronous orbital pattern (the satellite sub-point is not stationary).

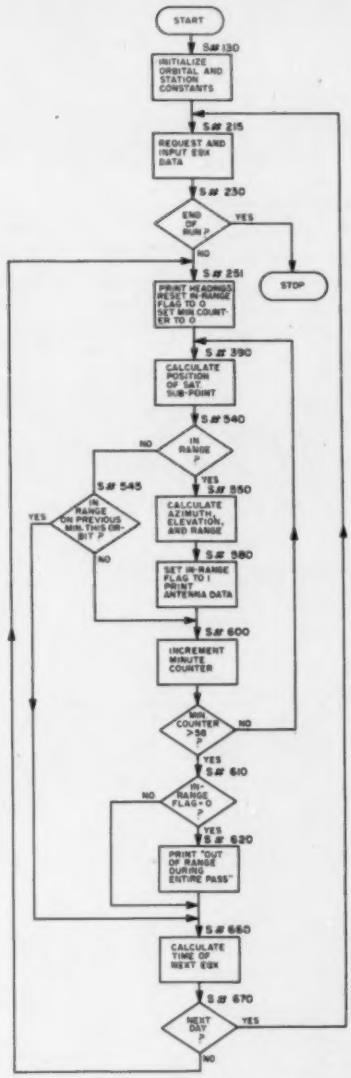

Fig. 2. A flowchart of the satellite tracking program.

Mathematics

The necessary equations to describe the orbital characteristics listed above are contained in the appendix. Without attempting any derivations or providing any lengthy explanations of the origins and ramifications of these equations, let's instead concentrate on what information the equations provide for us, and how we can utilize them in a computer program.

The first problem that we must tackle is that of pinpointing the location of the satellite sub-point at a given instant in time, knowing only the orbital characteristics of the satellite and the location of the satellite at a reference moment in time (such as at EQX). Equations 1 and 2 give us this means. It should be noted that the latitude of the satellite sub-point versus time depends only on the orbital constants of the satellite, and is not dependent on the longitude of the sub-point at EQX. However, the longitude of the satellite sub-point with respect to time is dependent on the longitude of the sub-point at EQX.

Equations 3 and 4, derived from general equations 1 and 2, are applicable only to OSCAR 7. Table 1 is a com-

Fig. 3. A listing of the BASIC version of the satellite tracking program.

```
OSCAR       10/11/78

10 REM-----------------------------------------------------------
11 REM--------   DIMENSION LAT. AND LONG. TABLES   ---------------
12 REM-----------------------------------------------------------
20    DIM Q(38),V(38)  'Q IS LAT TABLE ----V IS LONG TABLE
21 REM-----------------------------------------------------------
22 REM---------   FOLLOWING ARE PRINT USING STATEMENTS   ---------
23 REM---------     FOR FORMATTING THE PRINT OUT         ---------
24 REM-----------------------------------------------------------
30: EQX AT ##:##:## GMT AT ###.## LONG
40: MIN AFTER EQX        AZIMUTH          ELEVATION          RANGE
50:  ##                  ###.##             ##.##            #####
55: ORBIT NO. ##
100 REM-----------------------------------------------------------
110 REM-----    ORBITAL CONSTANTS AND STATION LAT AND LONG  -------
120 REM-----------------------------------------------------------
130     P=114.9458          'ORBITAL PERIOD IN MINUTES
140     KE=101.77           'ORBITAL INCLINATION AT EQX (IN DEGREES)
150     T9=28.73625         'MOVEMENT WEST ON EACH SUBSEQUENT EQX
160     A8=910.8            'ORBITAL ALTITUDE IN STATUTE MILES
170     K8=41.58Z           'STATION LATITUDE
180     K1=93.65W           'STATION LONGITUDE
185     'MAT READ Q,V       'READ SAT. LAT. AND LONG. TABLES
187     P9=6.283185/360     'DEGREE TO RADIAN CONVERSION FACTOR
188 REM-----------------------------------------------------------
189 REM--  CALCULATE THE MAXIMUM ANGULAR SEPARATION BETWEEN  -----
190 REM--     SATELLITE AND STATION WHILE STILL IN RANGE     -----
191 REM-----------------------------------------------------------
192     X2=3957/(A8+3957) 'RAT. OF DIST. OF STAT. TO SAT. FROM CENTER OF EARTH
193     GOSUB 9000        'FIND THE ARC COSINE OF THE RATIO
194     M9=X7             'STORE IN M9
195 REM-----------------------------------------------------------
196 REM-----------   INPUT EQX DATA FOR REV PASS   ---------------
197 REM-----------------------------------------------------------
215     Y=0               'INITIALIZE ORBIT COUNTER
216     PRINT
217     PRINT
218     PRINT
220     PRINT "ENTER EQX TIME FOR REV PASS (HR,MIN,SEC)"
222     PRINT "ENTER 99,99,99 TO STOP PROGRAM"
223     PRINT
224     INPUT T1,T2,T3
225     PRINT
230     IF T1=99 THEN 9999'STOP IF 99 ENTERED
240     PRINT "ENTER EQX LONG."
245     PRINT
249     INPUT,L9
251     FOR I=1 TO 15
252     PRINT
253     NEXT I
260 REM-----------------------------------------------------------
270 REM-----------   PRINT TABLE HEADING   ---------------------
280 REM-----------------------------------------------------------
285     Y=Y+1             'INCREMENT ORBIT COUNTER
286     PRINT USING 55,Y  'AND PRINT HEADING ON OUTPUT
287     PRINT
288     PRINT USING 38,T1,T2,T3,L9
289     PRINT
310     PRINT
320     PRINT USING 48
330     PRINT
340     Y=0               'INITIALIZE IN-RANGE FLAG
345     B=0               'INITIALIZE TABLE POSITION COUNTER
350     FOR I=0 TO 50 STEP 2 'BEGIN STEPPING THROUGH TIME FROM EQX
355     B=B+1             'INCREMENT TABLE POSITION COUNTER
360 REM-----------------------------------------------------------
370 REM-----------   CALCULATE SATELLITE SUB-PT   ----------------
380 REM-----------------------------------------------------------
400     S8=Q(B)           'PICK LAT. FROM SAT. LAT. TABLE (STORE IN S8)
480     GOSUB 3000       'FIND LONG OF SUB-PT (STORE IN S1)
410 REM-----------------------------------------------------------
420 REM-- CALCULATE GREAT CIRCLE DEG BETWEEN STATION AND SUB-PT --
430 REM-----------------------------------------------------------
432     IF S1<=180 THEN 448
434     S1=S1-360
440     L5=K1-S1                'FIND DIFF OF SAT AND STATION LONG
450     IF ABS(L5)<=180 THEN 500 'CHECK ABSOLUTE VALUE OF DIFF
460     IF (K1-S1)<0 THEN 490   'IF LESS THAN 180 NO MOD NEED
470     L5=L5-360               'IF MORE, SUBTRACT 360
480     GO TO 500               '              OR ADD 360
490     L5=L5+360               '                  TO PUT IN PROPER RANGE
500     GOSUB 4000              'DEG NOW IN D (0 IF OUT OF RANGE)
510 REM-----------------------------------------------------------
520 REM-----------   PRINT DATA ONLY IF IN RANGE   ---------------
530 REM-----------------------------------------------------------
540     IF D<>0 THEN 550        'JUMP TO 550 IF IN RANGE
545     IF Y=1 THEN 660         'IF PREVIOUSLY IN RANGE, STOP CALC.
546     GO TO 686               'IF NOT, CONTINUE CHECKING
550     GOSUB 5000              'CALCULATE AZIMUTH (STORE IN C)
560     GOSUB 6000              'CALCULATE ELEVATION (STORE IN E)
570     GOSUB 7000              'CALCULATE RANGE (STORE IN R)
580     PRINT USING 58,I,C,E,R  'PRINT DATA
590     Y=1                     'SET IN-RANGE FLAG
600     NEXT I
610     IF Y=1 THEN 660
620     PRINT "OUT OF RANGE DURING THIS ENTIRE PASS"
630 REM-----------------------------------------------------------
640 REM-----    CALCULATE TIME AND LONG OF NEXT EQX   ------------
650 REM-----------------------------------------------------------
660     T8=T1*3600+T2*60+T3-P*60 'CALCULATE NEXT EQX IN SEC
670     IF T8>24*3600 THEN 215   'EXIT LOOP IF LAST PASS OF DAY COMPLETED
680     T1=INT(T8/3600)          'CALC NEXT EQX HR
690     T2=INT((T8-T1*3600)/60)  'CALC NEXT EQX MIN
700     T3=T8-T1*3600-T2*60      'CALC NEXT EQX SEC
710     L8=L8+T9                 'CALC NEXT EQX LONG
714     IF L8<360 THEN 720
716     L8=L8-360                'IF REQ'D,SUBTRACT 360 TO KEEP IN 0-360 RANGE
720     GO TO 251                'LOOP BACK FOR NEXT PASS CALCULATIONS
730 REM-----------------------------------------------------------
732 REM-----     DATA FOR SAT. LAT. AND LONG. TABLES   ------------
734 REM-----------------------------------------------------------
800     DATA 0,6,12,18,24,30,5,37,42,5,49,54,60,65,71,76,78,78,75,72
810     DATA 65,59,53,47,41,35,28,22,5,16,11,5,-2
820     DATA 0,2,3,5,5,5,8,10,13,15,18,5,22,27,32,44,52,56,115,143
830     DATA 154,164,170,174,178,181,183,5,186,188,190,192,193,5,195,5
2950 REM-----------------------------------------------------------
2960 REM-----     SUBROUTINE TO FIND LONG OF SAT SUB-PT   ---------
2970 REM-----------------------------------------------------------
3030     S1=V(B)+L8               'LONG = TABLE VALUE + LONG AT EQX
3035     IF S1<360 THEN 3320
3040     S1=S1-360                'SUBTRACT 360 IF REQ'D TO KEEP IN 0-360 RANGE
3320     RETURN
3950 REM-----------------------------------------------------------
3960 REM--SUBR. TO FIND G.C. DEG BETWEEN STATION AND SAT SUB-PT --
3970 REM-----------------------------------------------------------
4250     X2=SIN(K8*P9)*SIN(S8*P9)
4310     X2=X2+COS(K8*P9)*COS(S8*P9)*COS(L5*P9)
4320     GOSUB 9000
4330     D=X7
4340     IF D<=M9 THEN 4360       'CHECK IF IN RANGE
4350     D=0                      'RETURN A VALUE OF ZERO IF NOT
4360     RETURN
4950 REM-----------------------------------------------------------
4960 REM-----  SUBROUTINE TO FIND AZIMUTH TO SAT SUB-PT  ----------
4970 REM-----------------------------------------------------------
5000     X2=SIN(S8*P9)-SIN(K8*P9)*COS(D*P9)
5010     X2=X2/(COS(K8*P9)*SIN(D*P9))
5020     GOSUB 9000
5030     C=X7
5032     IF L5>=0 THEN 5040
5033     C=360-X7
5040     RETURN
5950 REM-----------------------------------------------------------
5960 REM-----     SUBROUTINE TO CALCULATE ELEVATION     ----------
5970 REM-----------------------------------------------------------
6020     R=(A8+3957)*SIN(D*P9)
6010     E=E/((A8+3957)*COS(D*P9)-3957)
6220     E=ATN(E)
6025     E=90-360*E/6.28315
6030     RETURN
6950 REM-----------------------------------------------------------
6960 REM-----     SUBROUTINE TO CALCULATE RANGE     ---------------
6970 REM-----------------------------------------------------------
7000     R=((A8+3957)*COS(D*P9)-3957)/COS((90-E)*P9)
7010     RETURN
7950 REM-----------------------------------------------------------
7960 REM-------   SUBROUTINE TO CALCULATE ARCSIN   ----------------
7970 REM-----------------------------------------------------------
8000     IF X1>=1. THEN 8001
8001     IF X1<=-1. THEN 8003
8002     X9=90.0
8003     X1=-90.0
8010     X1=-90.0
8020     X8=(X1+X9)/2
8030     IF ABS(SIN(X8*P9)-X1)<0.0001 THEN 8090
8040     IF SIN(X8*P9)>X1 THEN 8070
8050     X1=X8
8060     GO TO 8020
8070     X9=X8
8080     GO TO 8020
8081     X8=90
8082     GO TO 8090
8083     X8=-90
8090     RETURN
8950 REM-----------------------------------------------------------
8960 REM-------     SUBROUTINE TO CALCULATE ARCCOS     ------------
8970 REM-----------------------------------------------------------
9000     IF X2>=1.0 THEN 9002
9001     IF X2<=-1.0 THEN 9004
9002     X9=0.0
9010     X1=180.0
9020     X7=(X1+X9)/2
9030     IF ABS(COS(X7*P9)-X2)<0.0001 THEN 9090
9040     IF COS(X7*P9)>X2 THEN 9070
9050     X1=X7
9060     GO TO 9020
9070     X9=X7
9080     GO TO 9020
9082     X7=0.0
9083     GO TO 9090
9084     X7=180.0
9090     RETURN
9095     END
```

pilation of the latitude and longitude of the OSCAR 7 sub-point versus elapsed time from an EQX at 0 degrees longitude. As previously stated, the latitude of the satellite sub-point versus time can be taken directly from the table regardless of the longitude at EQX. However, to determine the longitude of the satellite sub-point versus time, we must add the longitude of the sub-point at EQX to the value given in the table. For example, the longitude of the satellite sub-point 26 minutes after an EQX at 43 degrees longitude is 60.03 degrees (from the table) plus 43 degrees, equaling 103.03 degrees. The latitude at that moment, read directly from the table, is 75.48 degrees.

Now that we have the means of determining the position of the satellite at any given moment in time, we can employ equation 5 to find the angular separation in degrees of great circle arc between the satellite sub-point and the station for which we are calculating the antenna aiming data. While this intermediate result is of no value as it stands, it is required for the remaining calculations.

Equation 6 gives us the bearing in degrees from true North of the satellite sub-point from the station. Equation 7 then gives us the final piece of information we need for accurately aiming the antenna — the elevation in degrees from horizontal that the satellite appears above the horizon. The final equation, equation 8, allows us to calculate the distance in statute miles between the station and the satellite.

In all cases, the unit of distance is statute (not nautical) miles, and the angular units are degrees rather than radians. Equations 1, 2, 5, and 6 are applicable to any satellite with the previously mentioned general orbital characteristics. Equations 3 and 4 are specialized versions of equations 1 and 2, applicable only to OSCAR 7. As presented, equations 7 and 8 are also applicable only to

OSCAR 7. However, they can easily be modified for use with other satellites by replacing the constant 4867, which represents the sum of the Earth's radius and the altitude that the satellite orbits above the Earth's surface. For example, to modify the equation for a satellite that orbits 950 miles above the Earth's surface, simply replace the constant 4867 with 4907, the sum of the Earth's radius (3957 miles) and the orbital height of 950 miles.

While these mathematical manipulations are not exactly formidable, they are certainly not trivial. A great deal of number crunching is necessary to calculate antenna aiming data for just one moment in time, and even with the aid of a scientific calculator, the task of calculating an entire day's worth of aiming data would take hours of tedious effort. Fortunately, solving the equations is a snap for the digital computer.

Flowchart

Unfortunately, computer technology has not yet evolved to the point where computers program themselves. While eagerly awaiting this development, we are faced with devising our own problem-solving algorithms, and with the often tedious task of programming and debugging the software implementation of these algorithms.

Even with an adequate set of mathematical equations to solve the problem, such as those just discussed, they must still be arranged into a logical and orderly framework from which the computer can proceed. This is often an iterative process, a matter of trying many ideas, and determining by trial and error the most expedient (not necessarily the best) method of realizing a solution. Perhaps the easiest way of explaining the final choice of the algorithm is with a flowchart. A flowchart for the satellite tracking program is depicted in Fig. 2. Statement numbers have been affixed to the flowchart symbols, referring to the BASIC program statements of the listing in Fig. 3.

Beginning at statement 130, the fixed data for the program is initialized. Note that the latitude and longitude of the satellite sub-point versus time for an orbit with an EQX at 0 degrees longitude is stored in the program in two arrays (or matrices) and initialized at this time in statement 185. At statement 220, the computer asks for data for the reference pass (time and longitude of the first EQX of the day, as published monthly in *73* and other sources). If a 99,99,99 is typed in at this time, the program will halt (statement 230).

At statement 340, the in-range flag and minute counter are reset to 0. The in-range flag is a means by which the program can keep track of whether the satellite was ever within range of the station during a particular orbit. The minute counter is a register where the program remembers the minutes that have elapsed since EQX.

Beginning at statement 390, the program calculates the position of the satellite sub-point for the time stored in the minute counter. If the satellite is in range, antenna aiming data is calculated and printed (statement 550) and the in-range flag is set to 1, which will later remind the program that the satellite has been in range during at least one moment during the orbit. If the satellite is not in range, the program checks to see if it was in range during a previous minute of that particular orbit. If so, it knows that the satellite will not come into range again until the next orbit, and it branches to statement 660. If the satellite has not been in range during a previous minute of the current orbit, the program branches to statement 600, and after incrementing (adding 1 to the current value) the minute counter, checks whether over 58 minutes have elapsed since EQX. If so, the program prints an appropriate message and calculates the time of the next EQX. If 58 minutes have not elapsed, the program loops back to statement 390 to calculate the position of the satellite sub-point at the next checkpoint in time (two minute intervals in this case).

At statement 660, the time of the next EQX is calculated. If that time is still in the current day (before 24:00:00 GMT), the program loops back to statement 340 and repeats the entire process for the next orbit. If the next EQX occurs during the next day (after 24:00:00 GMT), the program loops back to statement 220, giving the

```
OSCAR       17:04CDT    10/11/76

ENTER EQX TIME FOR REF PASS (HR,MIN,SEC)
ENTER 99,99,99 TO STOP PROGRAM

? 0,26,54
ENTER EQX LONG.

? 56.6


ORBIT NO.  1

EQX AT  0:26:54 GMT AT  56.60 LONG

MIN AFTER EQX        AZIMUTH        ELEVATION        RANGE

      8               116.89             6.24         2436
     10               100.20            13.35         2363
     12                95.79            21.93         1718
     14                79.24            27.46         1545
     16                53.85            30.61         1462
     18                33.71            28.28         1522
     20                15.12            21.28         1740
     22                 5.36            14.41         2015
     24               355.61             6.45         2424


ORBIT NO.  2

EQX AT  2:21:50 GMT AT  85.34 LONG

MIN AFTER EQX        AZIMUTH        ELEVATION        RANGE

      4               178.42             6.24         2436
      6               173.14            14.38         2216
      8               160.30            25.30         1617
     10               137.47            41.10         1245
     12               220.80            68.94         1312
     14               283.14            64.10          990
     16               319.71            43.61         1285
     18               328.54            29.58         1488
     20               334.38            17.35         1889
     22               338.87             9.68         2245
     24               340.40             1.22         2752


ORBIT NO.  3

EQX AT  4:16:47 GMT AT 114.87 LONG

MIN AFTER EQX        AZIMUTH        ELEVATION        RANGE

      6               231.84             3.45         2635
      8               242.27             6.76         2426
     10               255.51            10.03         2227
     12               271.11            10.93         2191
     14               284.10            10.87         2184
     16               298.78             8.42         2312
     18               308.72             5.42         2484
     20               319.03             1.49         2733


ORBIT NO.  4

EQX AT  6:11:44 GMT AT 142.81 LONG

MIN AFTER EQX        AZIMUTH        ELEVATION        RANGE

OUT OF RANGE DURING THIS ENTIRE PASS
```

Fig. 4. Sample output from the satellite tracking program.

APPENDIX

Equation 1

A general equation for calculating the latitude of a satellite sub-point versus elapsed time from EQX.

$Lat(T) = \sin^{-1}(\cos(\text{sub-point bearing})\sin(360T/P))$

T = the elapsed time in minutes from EQX

P = the satellite orbital period in minutes

Sub-point bearing = the bearing of the satellite sub-point path at EQX (see Fig. 1)

Example — Given a satellite with an orbital period of 100 minutes, and a sub-point path that has a bearing of 330 degrees at EQX, find the latitude of the sub-point 10 minutes after EQX.

$Lat(10) = \sin^{-1}(\cos(330)\sin(360 \times 10/100))$

Lat(10) = 30.60 degrees North

Equation 2

A general equation for calculating the longitude of a satellite sub-point versus elapsed time from EQX.

$Long(T) = \cos^{-1}(\cos(360T/P)/\cos(Lat(T))) + (0.25T) + L_0$

T = the elapsed time in minutes from EQX

P = the satellite orbital period in minutes

Lat(T) = the latitude of the satellite sub-point as calculated with Equation 1

L_0 = the longitude of the satellite sub-point at EQX

Example — Given a satellite with an orbital period of 100 minutes, and a sub-point path that has a bearing of 330 degrees at EQX, find the longitude of the sub-point 10 minutes after an EQX at 100 degrees longitude.

$Long(10) = \cos^{-1}(\cos(360 \times 10/100)/\cos(30.60))) + (0.25 \times 10) + 100$

Long(10) = 122.46 degrees

Equation 3

An equation for calculating the latitude of the OSCAR 7 sub-point versus elapsed time from EQX.

$Lat(T) = \sin^{-1}(0.9790\sin(3.1319T))$

T = the elapsed time in minutes from EQX

Example — 10 minutes after EQX the latitude of the sub-point would be:

$Lat(10) = \sin^{-1}(0.9790\sin(3.1319 \times 10))$

Lat(10) = 30.590 degrees

Equation 4

An equation for calculating the longitude of the OSCAR 7 sub-point versus elapsed time from EQX.

$Long(T) = \cos^{-1}(\cos(3.1319T)/\cos(Lat(T))) + 0.25T + L_0$

Lat(T) = the sub-point latitude as calculated with Equation 3

T = the elapsed time in minutes from EQX

L_0 = the longitude of the satellite sub-point at EQX

Example — 10 minutes after an EQX at 20 degrees West longitude, the sub-point longitude would be:

$Long(10) = \cos^{-1}(\cos(3.1319 \times 10)/\cos(30.590)) + 0.25 \times 10 + 20$

Long(10) = 29.569 degrees West

---

operator a choice of requesting data for another day's orbits or for stopping the program.

Program Listing

The listing in Fig. 3 has been thoroughly annotated. The following comments should provide additional insight into the inner workings of the program and will hopefully expedite the process of implementing the program on other computers:

1) All the modifications required to use the program for calculating tracking information for other satellites are made in lines 130-180 and 800-830. Station location data is entered at lines 170 and 180.

2) Few will probably wish to leave the program exactly as it is once they get it running on their machine. An attempt has been made to keep the program structure modular so that new features can be easily added. Some of the following modifications and enhancements that might be made are:

a) Print out in local time rather than GMT (or UCT).

b) Print out orbital data in smaller or larger time intervals than 2 minutes.

c) Print out when both the local station and another station of interest are within range of the satellite.

d) Calculate the Doppler shift of the received signal.

e) Suppress printout during specified hours of the day.

f) Interface the program to an assembly language program to perform real-time control of the antenna during satellite passes, providing automatic operation.

3) Anyone who has had experience in trying to implement a "canned" program on any computer system has undoubtedly been faced with the task of converting certain non-standard code of the "canned" program to code that his particular system would accept. This consideration applies to both large and small systems, even in languages such as FORTRAN and COBOL, where there are generally accepted standards to promote program portability. Since the microcomputer field is still in its infancy, it should come as no surprise that the BASIC interpreter available from any particular manufacturer is more than likely different in at least some respects from the BASIC interpreter supplied by any other manufacturer. To my knowledge, there is not yet a standard on what features comprise the "4K", "8K", "12K", and "extended" BASIC interpreters being marketed by the various manufacturers and systems houses.

Without making a thorough study of the BASIC interpreters available on the market today, I would guess that the program as listed in Fig. 3 will run with very few modifications on most of the interpreters billed as "12K" or "extended." To execute the program on the more elementary interpreters, some or all of the following modifications will be required:

a) Delete the latitude and longitude tables from the program and add subroutines to directly calculate the satellite sub-point latitude and longitude each time it is required. The essence of the required mathematics for this conversion is contained in equations 1 and 2 in the appendix. The Q and V matrices can then be eliminated from the program, allowing the program to be executed by interpreters that cannot support matrix variables. This modification will have the effect of minimizing the amount of memory required, but will measurably slow down the execution of the program.

b) Substitute iterative routines and approximations for the library trig subroutines in the program. There are a number of handbooks on the market that describe techniques for performing trigonometric and other transcendental functions on simple four function calculators. These techniques can be utilized in developing simple subroutines to provide approximate function solutions that will be accurate enough in this application. This will allow the program to be executed on machines that cannot support trig functions.

c) Delete the "PRINT USING" statements from the program. They are used to format the output in a particular fashion, but are certainly not essential to the program. The output can then be formatted in

Equation 5

An equation for calculating the angular separation of a station location and a satellite sub-point.

$D = \cos^{-1}(\sin A \sin B + \cos A \cos B \cos L)$

D = the angular separation in great circle degrees of arc between the station location and the satellite sub-point

A = the latitude of the station in degrees

B = the latitude of the satellite sub-point in degrees

L = the station longitude minus the sub-point longitude. If the algebraic difference is outside of the range of -180 to +180 degrees, add or subtract 360 degrees, whichever will result in a value in the range of -180 to +180 degrees.

Example — Given that the station is at 39 degrees N. latitude and 77 degrees W. longitude and the satellite sub-point is at 23 degrees N. latitude and 63 degrees W. longitude, the angular separation is:

$D = \cos^{-1}(\sin 39 \sin 23 + \cos 39 \cos 23 \cos 14)$

D = 19.95 great circle degrees

Equation 6

The equation for calculating the true bearing from a station to a satellite sub-point.

$\text{Bearing} = \cos^{-1}((\sin B - \sin A \cos D)/\cos A \sin D)$

A = the latitude of the station in degrees

B = the latitude of the satellite sub-point in degrees

D = the angular separation of the station and sub-point as calculated in Equation 5

Bearing = degrees clockwise from true North of the position of the satellite sub-point with respect to the station. If the value of L in Equation 5 was negative, the bearing is (360 - bearing).

Example — For the conditions in the example of Equation 5:

$\text{Bearing} = \cos^{-1}((\sin 23 - \sin 39 \cos 19.95)/\cos 39 \sin 19.95)$

Bearing = 139.23 degrees from true North

Equation 7

An equation for calculating the antenna elevation for tracking OSCAR 7.

$E = 90 - \tan^{-1}(4867 \sin D/(4867 \cos D - 3957))$

D = the angular separation calculated in Equation 5

E = the angle above the horizon of a straight line between the station and the satellite

Example — For the conditions in the examples of Equation 5 and Equation 6:

$E = 90 - \tan^{-1}(4867 \sin 19.95/(4867 \cos 19.95 - 3957))$

E = 20.41 degrees

Equation 8

An equation for calculating the distance from a station to OSCAR 7.

$M = (4867 \cos D - 3957)/\cos (90 - E)$

D = the angular separation calculated in Equation 5

E = the elevation calculated in Equation 7

M = the distance in statute miles between the station and the satellite (its true position, not the sub-point)

Example — Using the same conditions as for the examples in Equations 5-7:

$M = (4867 \cos 19.95 - 3957)/\cos (90 - 20.41)$

M = 1771.93 miles

other ways by the user.

Conclusion

The intent of this article has been to present sufficient information on a satellite tracking program so that the interested individual can implement the program on any computer he might have at his disposal. While the version presented here is admittedly a minimal configuration, the additions or refinements to enhance operating convenience should not be difficult. I will gladly assist anyone who encounters difficulties if the questions that arise are submitted along with an SASE. ■

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"How to Find the Satellite," WB8DQT, *73*, Jan., 1975.

"Bearing and Distance Calculations By Sleight of Hand," K1PLP, *QST*, Aug., 1973.

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Building the Polymorphics Video Board

-- the voice of experience

Glen Charnock WB6JKM
864 Palomar Way
Oxnard CA 93030

For someone who is primarily a software-oriented person, I seem to do a lot of hardware building. In September, 1974, I started building TVT-I. I got it working in December and had it connected to my Altair 8800 in December, 1975. A friend, also with an Altair, built TVT-II and it was so much faster and better designed that I sold my TVT-I and built a TVT-II. I didn't keep detailed notes on the construction of these two projects, but I learn from my mistakes. When another friend showed me his Polymorphics video board, I knew I was doomed. This video board plugs directly into the Altair or IMSAI bus, eliminating a large boxfull of power supply, TVT-II, and cables, and frees the parallel I/O port I used with the TVT-II. This time I kept notes on the subject. The kit is of good quality and there should be no more than the normal problems putting it together; nevertheless, there are some pitfalls. This article will explain the ones that I encountered and how to solve them.

The video board appears to the program to be a block of random access memory which is constantly displayed on your monitor or modified TV. The display has sixteen lines which may be either 32 character lines ($185) or 64 character lines ($210). The 32 character lines will probably work with a modified TV which has a bandwidth of 2.5 MHz, but the 64 character lines may require a monitor, as they need a bandwidth of 5.5 MHz. The memory uses 91L11 chips and acts as a normal memory. It can be used for program or data storage in addition to its normal uses. Data may be entered into any of its memory locations at any time, giving the capability of scrolling, paging, columns, fixed format entry, or any other display mode you would like to use. This flexibility requires suitable programming – more on this later!

An 8-bit parallel input port is built into the video board so that a keyboard may be attached, thus giving both input and output from one board. Unfortunately, there is no corresponding status port for this input port, so the program must check the data to see if it has changed in order to know when new data is available – again, more programming overhead.

The 6572 character generator chip provided with the kit gives 128 ASCII characters, including upper and lower case, numbers, and special symbols. Lower case Greek letters print in place of the ASCII control characters. Other chips in the same series may be substituted, giving different special symbols instead of the Greek letters. The graphics display is handled external to the 6572 chip. The character space is broken up into six spaces – three rows of two blocks each, giving 64 possible graphics characters. The blocks cover the entire character space so that the entire screen may be made light with no spaces between characters.

Buying The Kit

When I decided that their kit would satisfy my needs, I called Polymorphics and asked them to send me a kit.

I've learned several things from the boards that I've already built. I use sockets for all ICs (sockets come with the Polymorphics video board) and I test all of the parts that I can test. These two things can save hours of time later in the project when it doesn't work.

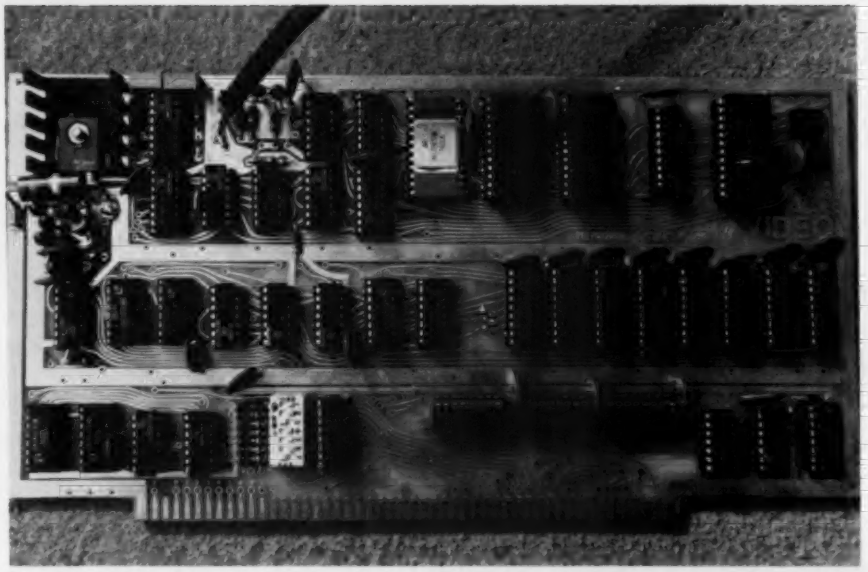
The first thing I did when I opened the box was to look at the instruction book. This is an impressive manual of about 72 pages and covers assembly, theory, troubleshooting, and software. The section on troubleshooting is especially impressive as many kits have no such section. Polymorphics devoted 16 pages to troubleshooting, arranged in a logical manner. Hopefully you won't need it (I didn't), but it's nice to know that it's there and reading it will help give you a better understanding of the circuits involved.

Building The Kit

The first part of kit-building is checking the parts supplied against the parts list. I was missing a 27 pF capacitor and a 150 Ohm resistor, but it turned out that neither part was used in the kit. A 1N759 12 V zener diode was also missing, but a 78L12 was supplied instead. An extra 10 uF electrolytic capacitor was included and was used in the kit.

Having determined which parts were supplied, the next

step was to test all that I could. It is much easier to find a shorted capacitor, for example, when you have not yet mounted it than it is to find it when you discover that your board doesn't work! The resistors supplied with my kit were all within tolerance, but I found that one end of one 10k Ohm trimpot was open. I was able to use it for R22, so it caused no problem. I checked the capacitors for shorts and observed the charging of those over .01 uF. All capacitors tested good. All diode and transistor junction resistances (forward and backward) were good. By inspection I found a solder bridge on one of the ICs. This is not uncommon and can cause a lot of grief if it isn't found before the IC is mounted.



Getting It All Together

The assembly instructions are aimed toward the person who has had some prior kit-building experience. A drawing of the board is given showing the locations of the various parts. Each part is listed with a space to check as each is soldered in place. The drawing in my manual was smeared in places so that I couldn't read the parts labels. I was able to get the needed information from a friend with a Polymorphics video manual with a clear drawing. There were also two pages missing from my manual which I was able to copy from his. Further confusion can arise from C25, which is labeled .01 uF on the schematic but is given as 4700 pF in the assembly instructions (4700 is correct). The polarity is not given for one of the electrolytic capacitors and is shown reversed on the schematic for one of the others. It may be obvious to everyone but me, but I still think that a note should be included telling which way to orient the trimpots so that they can be adjusted while the board is in operation. I also think that instructions on connecting the video output cable should be included.

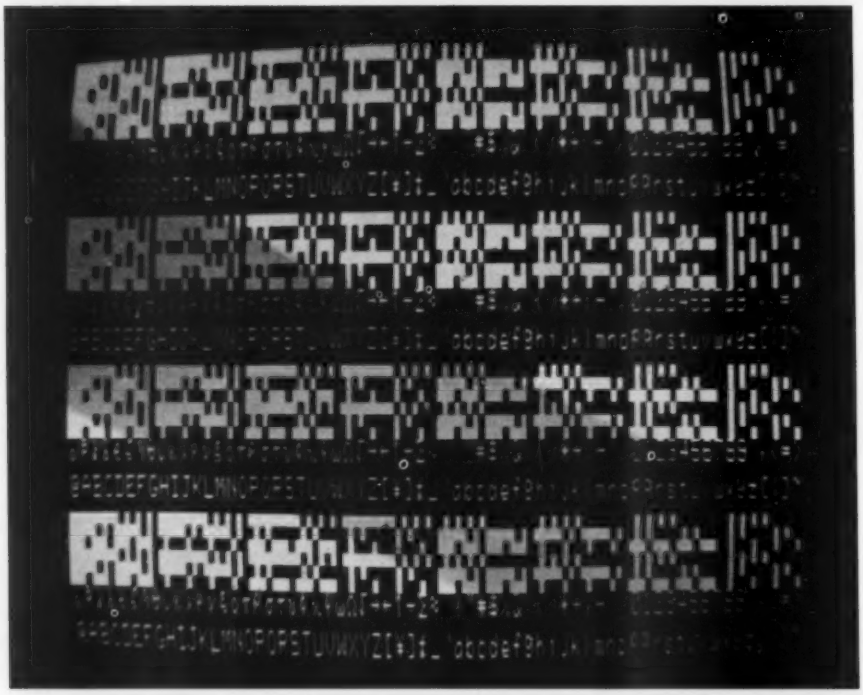
In all, construction time was probably well under 10 hours, but it is hard to tell when the time available to work on it comes in blocks of 30 minutes or less. In any event, the moment of truth finally came. I plugged it in and turned power on. A few quick adjustments of the horizontal and vertical controls on my monitor and voilà – a screen with funny-looking characters on the left side of the screen and wavy lines running from top to bottom. The characters didn't look too good either. A quick voltage check: Yipes! 6.6 volts instead of 5.0. Replacing the 7805 regulator brought the voltage down to an acceptable 5.06 volts. I decided that it is worthwhile to test voltage regulators also! Somewhat afraid that, after the 6.6 volts, I now had a board of write only memory, I tried again. No ripple this time and the voltage was good, but the characters were still all at the left side of the screen and still looked funny. I could enter characters or change them but they looked like negative images. Enter my friend again. I had used twinlead to connect the board to my monitor because I didn't have any coax handy. (No cable is supplied with the kit.) My eagle-eyed friend pointed out that I had reversed the connections to the monitor, thus reversing the video. This also caused the monitor to sync on the first white square (black in the negative image) on each line, thus preventing me from centering the display. Changing the cable restored a positive image and fixed the sync. The board now worked just fine with respect to hardware.

Apparently there is a problem with some monitors due to the fact that the video board operates at 17.094 kHz, which is above the normal horizontal sweep frequency. Instructions are given to lower the board's frequency if required. It is also possible to use an onboard crystal to obtain any desired sweep frequency. Normally the signals are divided down from the 2 MHz clock on the CPU board. This modification was not needed with my Sanyo VM-4092 monitor.

Software – The Last Pitfall

Because the board is so versatile, the software to control it is complex and lengthy. For paging, the control software must determine where the character is to be put, control a cursor if desired, and watch for end of page. Line feed and carriage return instructions must be intercepted and handled as well as any optional commands you wish to implement, such as backspace or backline, etc. One problem which could have been avoided is the fact that the board looks at the most significant bit to determine whether to display an ASCII character or a graphic character. If the bit is a 1, the ASCII is displayed. Most packaged software, such as MITS BASIC, will mask this bit to a zero so the video control software must also fix this bit.

Polymorphics includes a listing of a program to control their board. It allows for input from their keyboard using interrupts to determine when data is valid. The program offers quite versatile control of the display. Home, erase, right, left, down, delete character, insert character, etc., as well as optional paging or scrolling, are available under software control. The video control routine is 455 bytes long and is given as an assembly listing in hexadecimal. It uses memory locations Ø through 44 and 1DØØ through 1E83. The board is assumed to start at memory location 88ØØ hex. This is a



lot more overhead than a simple I/O port which might use 20 bytes. The best idea is to put the driver routine in PROM. Another disadvantage is that this video output will not be compatible with other packaged software such as MITS BASIC, although such programs can be modified to call the video driver.

Another program listing is included in the manual. This one plays the "game" of LIFE. LIFE loads into memory locations Ø through Ø1Ø6 hex and also uses blocks of memory starting at 3ØØ and 8ØØ hex.

Since I work in octal, don't have an assembler operating, and these routines overlay my control programs, I don't have either of them loaded yet. Both are well-documented with comments, though neither appears to use structured program techniques. It should not be difficult to get them running.

Summary

Overall, the kit seems well-designed. Except for a bad part (the voltage regulator) and my own stupidity (the reversed video cable), the board would have worked the first time. Even if it hadn't, the troubleshooting section seems well thought out and requires no test equipment but a voltmeter and your monitor. I built it and I'm glad I did. ■

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Robert C. Brehm WB6QFA
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Today's RTTY amateur has available a choice of equipment and techniques that allow him to develop sophisticated radioteletype-computer links which were only dreamed of several years ago. Moreover, with the ever-increasing usage of RTTY on VHF repeaters, the feasibility for radio-linked computer programming from a central computer is not only plausible, but is on its way to becoming a reality.

This article provides a general introduction into amateur RTTY as well as a chronological background of RTTY developments over the past 15 years. This article should familiarize non-RTTY amateurs and computer hobbyists with the early developments and how they have influenced the current state of the art. Finally, I have taken the liberty of predicting what the marriage of microprocessors and RTTY will bring in the future. So pull up your easy chair, relax, and follow me as I take you down the evolutionary path of amateur radio TTY.

Amateur RTTY – What Is It?

Amateur radioteletype, or RTTY for short, started in the early 1950's when many of the military surplus teleprinters and associated equipment became readily available at reasonable prices. In addition, in 1953, the FCC allowed amateurs to use RTTY on all frequency bands above 3.5 MHz.

In the early days of RTTY, activity on the ham bands was split between groups who primarily worked the frequencies below 30 MHz and those who were content to use VHF frequencies. One group desired long distance RTTY communication while the others used RTTY for local net-type operation.

In those days RTTY was, and still is, transmitted in one of two ways on frequencies below 30 MHz. The first method, called frequency shift keying, or FSK, involves changing the carrier frequency each time a mark or space pulse is encountered during a character's transmission. Using FSK, a constant carrier is transmitted for a mark pulse, with a space pulse causing the carrier to shift down by 850 Hz. More recently, common practice has changed the shift to 170 Hz due to the increasingly crowded ham band signals which cause interference within the wider 850 Hz shift. The other common method of RTTY transmission utilizes audio frequency shift keying, or AFSK. With this method, a pair of audio tones is fed into a single sideband system, utilizing a well-suppressed carrier and operating in the lower sideband mode. The shift of the audio tones, usually generated with 2125 (mark) and 2295 (space) Hz signals, again presents a 170 Hz signal to a copying receiver. On the receiving end of things, both FSK and AFSK generated signals sound exactly alike, and it is unlikely that you could tell them apart. On VHF, the audio tones are usually fed into an AM or FM transmitter using either 850 Hz or 170 Hz shift, depending upon which shift is being used in the particular area.

The AFSK signal generation used in RTTY is similar to the AFSK used in most computer-telephone-modem links except for the frequencies of the tones. Another obvious difference is the transmission media, which is radio waves instead of telephone wire pairs. The RTTY speed of 60 wpm (45.5 baud) is also somewhat slower than conventional modems which operate at 110 or 300 baud. The code used for RTTY is the common 5 level Baudot code which has 32 characters in the "letters" mode and another 32 in the "figures" mode; however, not all characters are used.

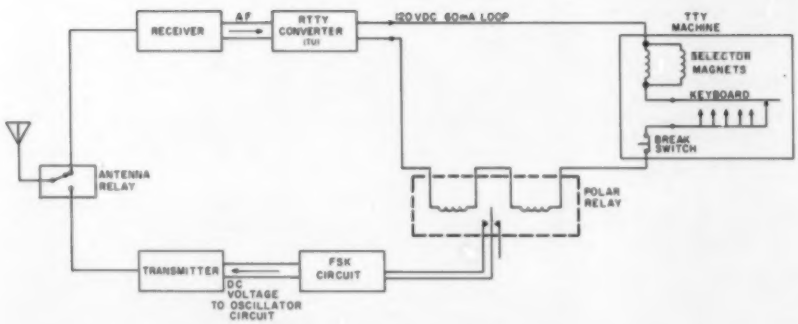

Fig. 1. Early RTTY FSK system.

The similarity between modems used on computers and modems for RTTY, which are called terminal units, also exists on the reception end. Most common of the terminal units are ones with tone selective filters which respond to 2125 and 2295 Hz tones taken from the receiver speaker terminals. Additional circuitry is often incorporated to compensate for selective fading of signals and space-only or mark-only copy. The terminal units basically function as tone decoders which drive a tube or transistor keying stage adjusted for 60 mA of printer loop current. A typical receiving system is shown in Fig. 1.

In this setup, the converter (TU) connects to the audio output of the receiver, and modulates (keys) a 120 V dc "loop" adjusted for 60 mA of current required by the selector magnets of the teleprinter. The keyboard of the teleprinter is also connected in series with the loop supply; consequently, whenever a key is depressed, it breaks the loop in a predetermined sequence, which causes the printer to print that character. In addition, when the transmitter is on, depressing a key will cause the Baudot encoded character to be transferred through a polar relay into an AFSK generator which can modulate the transmitter.

Transmitting and receiving are conceptually easy to understand although, depending upon the accessories that are hooked into the system, the switching circuitry can get quite complicated.

Many amateurs started with simple setups as shown in Fig. 1; however, they soon learned that adding accessories could significantly enhance both receiving and transmitting operations. Early in the RTTY game, most additions to the RTTY station were mechanical in nature. Paper tape perforators and transmitter distributors (tape readers) were probably the first added luxuries. These items allowed you to punch a tape for transmission later at full speed. It is common practice to punch a tape while the other person is sending to you, so that when he is done, you can immediately start sending back to him. Another mechanical feature which proved to be quite popular was the stunt box available in the Model 28 machines. This mechanism allowed the printer to decode or "recognize" certain characters or combinations of characters in such a manner that a switch closure (or opening) could take place. This feature, in conjunction with an option called answerback (part of an item called a WRU or who are you?), allowed a person's machine to answer or transmit back a programmed message when queried with a preprogrammed recognition sequence. Some Model 28s are even equipped with back space and reverse line feed so you can "roll up" what has already been typed. Imagine coming home to a spindle of paper all rolled up and printed!

Many of the above mechanical features were coupled with a very popular option called autostart, which is short for automatic starting. This feature allows your TU to be activated by a steady mark tone lasting a given duration (usually about 3 seconds or more). Although employed to a limited extent on the low bands, autostart TTY is used quite extensively between club or net members using the VHF bands for local communications. The principle involved with autostart is simple. As an example, suppose you have a receiver monitoring your favorite channel and while you are out at a swapmeet, one of your friends calls you on the radio to leave you a message. When he transmits a continuous mark tone for 3 seconds, your TU responds by turning your printer motor on and subsequently prints your friend's message and shuts itself off again ... all automatically. When you arrive home, the message is there waiting to be read. This feature is obviously very useful, and many amateurs monitor a given frequency 24 hours per day in order to be in constant communication with their friends.

Glossary

POLAR RELAY:	*A springless relay built by winding a magnetic core with two equal but opposite windings. The armature stands theoretically in the middle of the two windings. This kind of relay permits the operation of a RTTY circuit that has a current flow in one direction for mark and in the opposite direction for space.*
POLAR SIGNALS:	*Signals in which the current in the transmission line is reversed in polarity in changing from marking to spacing.*
NEUTRAL SIGNALS:	*Signals sent in the form of direct current pulses for marks and an absence of current for spaces.*
REGENERATIVE REPEATER:	*A circuit which samples incoming signal pulses and retransmits them with perfect timing and no distortion.*
DIDDLE:	*Automatic transmission of letters or figures characters by the TU if no characters are ready for transmission (most often used with a FIFO or memory).*
BAUDOT:	*Five level code used primarily by amateurs in RTTY communication. Only code allowed by FCC without special waiver.*
ASCII:	*American Standard Code for Interchange of Information (commonly used in computers).*
TU:	*Terminal unit or amateur RTTY version of a modem.*
QSL:	*Written acknowledgement of two-way radio communication.*
FIFO:	*First In, First Out stack. Used for storing data for retransmission (communication applications).*

The 1960's

These mechanical marvels were quite the state of the art in the mid and late 1950's. But around 1960, with the ever-increasing use of the transistor by amateurs, many of the functions previously performed by mechanical means were being performed by electronic circuits.

Probably one of the first mechanical items to give way to electronic circuitry was the ubiquitous polar relay. This relay was used in the polar circuitry of terminal units where current flowed in one direction for space and in the opposite direction for mark. Thus the relay could key a local loop supply for a teleprinter when driven by tone decoders. This electronic "advancement" in modern technology, utilizing such components as SCRs and switching transistors, got rid of noisy clicking relays which often got out of adjustment or were plagued with dirty contacts. More importantly, however, it also sparked the beginnings of the evolution of solid state technology in RTTY applications.

It is interesting to digress for a moment and reflect upon the paths taken in the "evolution" I have just mentioned. First of all, it was a dual affair, with the VHF RTTY folk applying solid state technology to AFSK methods and terminal units in the early 60's. The other concerted effort was made by the lower frequency RTTY men who seemed to lag behind technologically, prob-

ably due to the more severe reception problems associated with static noise, signal fading, and changing atmospheric conditions. The progress of both groups can be put into perspective by observing Fig. 2, a time line showing RTTY evolution derived from a study of articles published in *73, QST, CQ, Ham Radio,* and the *RTTY Journal* during the 60's.

It is easy to draw several conclusions from Fig. 2. First, we observe that transistorized TUs are introduced early in the 60's but are used primarily on VHF where receiving conditions are almost identical to modem reception over telephone lines. On the other hand, FSK terminal units were still built primarily with tube circuits without bandpass filters but using clunky polar relays. However, in 1965, FSK RTTY really got a push due, in most part, to a one-man effort by Irv Hoff, who published no less than ten articles in *QST* covering all aspects of RTTY. He also shared the design credit for the Mainline TT/L FSK demodulator which, for FSK, was the state of the art even though it used tubes. During the rest of the 60's, solid state and digital technology continued to be used primarily in VHF with the introduction of such items as a digital Selcal (selective calling unit similar to a mechanical stunt box), crystal controlled AFSK generators, and IC RTTY converters. In contrast, tube circuitry was still being used in the TT/L-2, an improved TU for LF described in a 1969 *QST* article. However, autostart techniques were catching on in the LF spectrum and diode FSK circuits were in common use.

Overall, it was rather apparent, during the 60's, that VHF RTTY amateurs were closer to using state of the art digital technology than their LF RTTY compatriots. The reason for this difference is not quite clear, although it may be due to the fact that VHF RTTY amateurs, by virtue of continually talking (printing) with the same people on net frequencies, generated more ideas and techniques than the LF hams who tended to have less frequent contacts in a more or less hit and miss fashion. However, in the 1970's the technological difference between the two groups has become less and in fact may have become equal.

1960
- Polar relays used extensively
- Tube converters for low frequency (LF)

1961
- Simple VHF transistor TU
- Transistorized AFSK

1962
- Garden City TU (LF)
- FSK without polar relays
- Introduction of bandpass audio filters for RTTY

1963
- Chemical City TU (LF, mark only, space only copy)

1964
- Crystal controlled FSK
- More transistorized TUs – VHF with autostart

1965
- UT AFSK OSC – VHF
- RTTY articles by Irv Hoff
- FSK with SSB transmitters used extensively
- Mainline TT/L FSK Demod (First good LF TU using bandpass filters and all other previous TU features and new innovations – tube TU!)

1966
- Diode FSK circuits
- High performance RTTY filters

1967
- Autostart RTTY – low frequency
- More solid state VHF TUs and AFSK gen.

1968
- First RTTY Selcal introduced – digital ICs – VHF

1969
- Mainline TT/L-2 – improved TU for LF (Tubes)
- IC RTTY TU and AFSK (ICs introduced to RTTY – VHF)
- Crystal controlled AFSK – IC technology

Fig. 2. RTTY Evolution – 60's.

The 1970's

The 1970's have brought us not only a digital revolution in consumer and industrial products, but also in RTTY, both for low frequency and VHF application. Fig. 3 illustrates this evolution in both areas of RTTY operation.

In the 70's, LF FSK circuitry quickly began to catch up with VHF RTTY circuitry. In 1970, the ST-3 and ST-5 terminal units were pioneered by Irv Hoff. Although designed primarily for VHF, they have been used extensively for LF also. In 1971, the ST-6 was born. This TU represents a solid state attempt to incorporate the circuitry developed in the TT/L-2 in the late 60's. It incorporated mostly op amps of the 709/741 series. Even today this TU is the most popular and widely used on the LF bands.

Very few major technological differences have taken place in LF RTTY TU technology since the advent of the ST-6. Most changes have involved accessories which interface with the ST-6 and provide more convenient operation. In 1971, speed converters using discrete components were introduced, as were preprogrammed digital message generators. In 1973, a crystal controlled digital audio synthesizer was described for AFSK generation with SSB transmitters. 1973 also brought several new accessories to the RTTY community, including video displays for Baudot, digital keyboards, digital autostart units, and Morse code to RTTY converters using discrete TTL circuits. 1974 was also a good year for technological developments in digital LF RTTY and the introduction of UARTs in RTTY circuitry.

Lest we not forget VHF during the 1970-74 period, it should be mentioned that the phase lock loop (PLL) was used in several TU designs taking circuitry ideas modeled after the PLLs used in computer modems.

It was in 1975, however, when the RTTY technology really exploded, just shortly after the introduction by MITS of the Altair 8800 microcomputer. In 1975, several articles described programmable RAM message

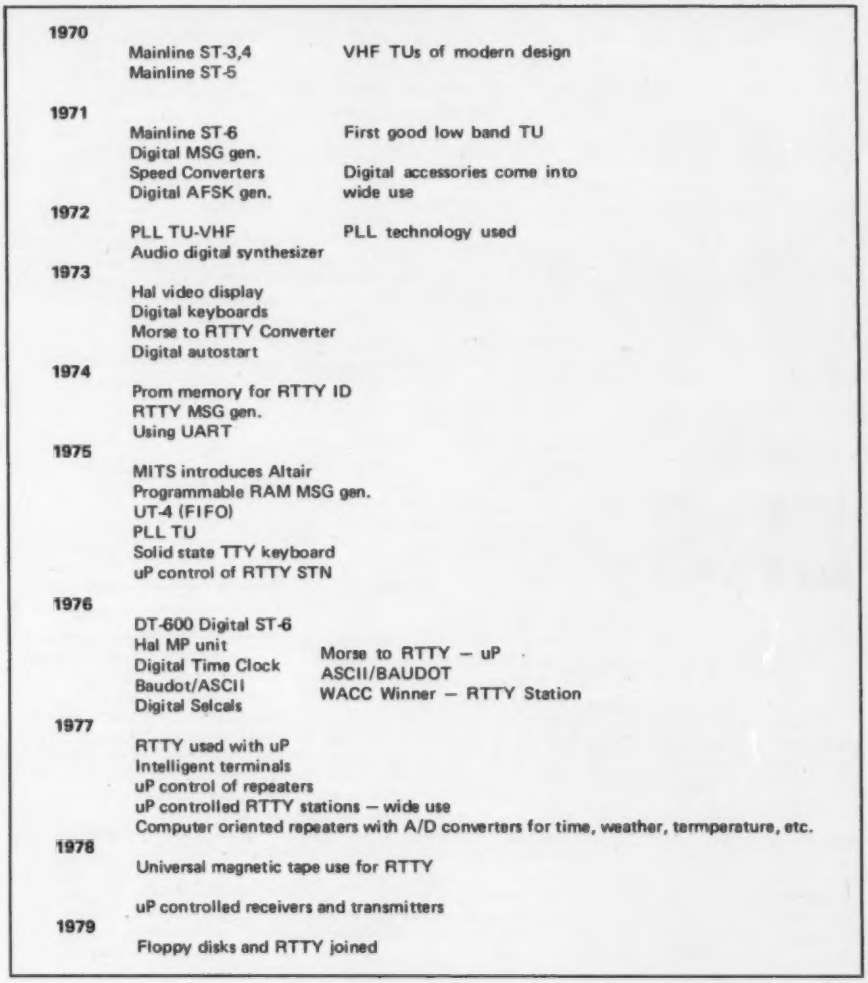

Fig. 3. RTTY Evolution – 70's.

generators. Also UARTs and FIFOs were becoming very popular among the LF gang (principally those monitoring 3612.5 MHz on the West Coast). It finally looked like LF and VHF techniques had caught up with each other! In late 1975, we began to observe the influence of microprocessors as evidenced by several articles which outlined microprocessor controlled RTTY stations both on VHF and LF.

This exciting trend has continued to accelerate at an increasing pace as the availability of hardware and software technology becomes more widespread. Hal Communications has introduced an 8080 based RTTY terminal; digital Selcal circuits are springing up everywhere; ASCII to Baudot and Baudot to ASCII code converters have been written up in several magazines with commercial units now available; and, to top it all off, the grand prize winner at the World Altair Computer Conference was a computer controlled RTTY station! We have certainly come a long way from the days of polar relays and tube converters!

So here we are in 1977, the year of the microprocessor in RTTY; where to go now? Let's look back for a second and envision a typical advanced RTTY station of 1976. With a microprocessor you have the capability to send and receive Morse code (at any speed), send and receive RTTY in Baudot or ASCII (for OSCAR satellite work), look like a super FIFO/UART combination, perform as a stunt box, Selcal, regenerative repeater, digital autostart, diddle and antididdle device, automatic logging unit, RY generator, memory box for contests, callsign lookup and recorder, or any other digital device you can dream up and interface to your microcomputer.

OK, so what's left, you may ask. If you let me take the liberty of gazing into my crystal ball, here is what I see. First, I can see quite clearly the ever-increasing use of micros like the 4040, 8008, 8080, 6800, 6502, SC/MP, etc., in amateur designed circuits dedicated to RTTY. By mid-1977 the majority of RTTY amateurs should have some type of micro in use in their station, even if only to look at! Many of the micros will be used to provide intelligent terminals which can be used for text editing before transmission and for preparing data for storage on a tape cassette.

It is also reasonable to expect microprocessor controlled radio repeaters in 1977 for both RTTY and voice applications. These will be interfaced with A/D converters which could give time, temperature, weather reports, etc., when certain access codes are received by the computer. In addition, I foresee more sophisticated remote monitoring of repeater technical parameters, where voltages, temperature, and currents are transmitted in ASCII, when inquiry codes are received by the repeater. In the late 70's it is also likely that RTTY repeaters will be linked across the state, or country, thus allowing the computer amateur to converse with others thousands of miles away.

I also can see the increased use of magnetic tape for file storage of RTTY pictures and other information generated on the computer. Five level tape will become more and more scarce as cassette tape standards begin to dominate the scene.

Also, in 1978, "canned" software for your favorite computer routines will be readily available from your ham or computer dealer. RTTY computer repeaters will also be very popular and will feature computer software for circuit calculations, antenna bearings, QSL information, and other applications. As costs come down on floppy disks in late 1978, early 1979, more amateurs will be using them for DX contest record-keeping, QSL info, magazine indexes, and personnel accounting records.

In addition, with the widespread use of video disk and video terminals, more computer amateurs will be transmitting and receiving video messages and symbols. Image processing and computer graphics will be fully developed on the RTTY frequencies. Who knows, your computer may be talking to my computer by 1980 and all I will have to do is lick the stamp on the QSL! Who said we're not a push-button society?

As you can see, we have come a long way over the past 15 years and we still have a long way to go. The journey of the future will be just as exciting as the one we have recently finished. You can take part in the evolution to whatever extent you desire. I know I will be there building microcircuits, reporting them to you in future articles and enjoying every minute of it.

So come on! If you missed the last 15 years, it's still not too late; you can start now on the next 15 years and maybe you'll be the one to write the next evolution of RTTY article in 1991. ■

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LETTERS

from page 10

got any suggestions?

And last, you've got a great mag. You've got 3 times the articles and twice the quality of the next best mag. I haven't read a *QST* in months. I only wish my subscription had run out this summer so I could take advantage of your 3 year/$17.76 offer!

Eric Unruh WBØRYN
Newton KS

WASTED PAGES

Obviously you are still experiencing some negative feedback regarding the involvement of *73 Magazine* in the subject of computers. I would like to comment. I submit that you have not yet presented the computer in such a way as to attract the greatest number of your readers. This is assuming that you have readers from age 14 through 65 years, and that they do not all have strong technical backgrounds. Or it may be that to many, although employed in some field of electronics, it's not necessarily digital electronics. (Many linear cats find the conversion to a digital world to be a painful process.) It should be clear that if an article on computers is written at a level for computer engineers, then for hundreds of ham subscribers who are oriented differently, that material represents 4 or 5 wasted pages in their magazine. Therefore, I propose that you seek and publish articles telling us why we should all be interested in the subject of computers. We should be told exactly what a computer will do for us. We should be told why it is necessary to "program" a computer, with simple elementary examples of "storage," "retrieval," and "processing." This should be written in simple definitive English, avoiding the use of professional programmer's terminology.

Let us move ahead on the subject of computers in *73 Magazine*, but starting at the appropriate point. Leave the advanced material to such publications as *Byte*, *Kilobaud*, *Megabyte*, etc.

I would like to emphasize that the foregoing does not apply to your many other fine articles involving digital techniques. These I regard as excellent for hams. I have just completed my own functional frequency counter built by me using information from at least 5 or 6 different articles published in *73*.

Harry D. Minshew W6ZOW
Hemet CA

Sorry, Harry, But Kilobaud *won't have that advanced material you mentioned any more than the I/O section of 73 will. I understand, and can relate to, your remark about how difficult it is to make the conversion from the "squiggly lines" to the world of "1s and 0s." Keeping this in mind, I am constantly trying to get material for the I/O section for beginners. On the other hand, there are a number of hams who have been in this for awhile and would like to see some good applications material. My job is very simple . . .just make everyone happy (hi). – John Craig.*

THE PRICING GAME

I just received the Holiday 1976 issue of *73*. After my first scan through (I generally make several passes), I noticed an ever-increasing trend by manufacturers to eliminate the price of equipment from their advertising. Why do they do this? It is difficult to compare similar products by different manufacturers if the reader has no idea if the price range is the same. How can the prospective buyer know which rig is best suited for his individual situation?

For example . . . Kenwood has a number of full page ads, back cover, 2, 67, 70. No prices on any piece of equipment. Ditto KLM's full page inside front cover. Same goes for Icom . . . 5, 42, 43, 55. How about Hy-Gain on page 7 and Ten-Tec on page 30? Even my friends at Klaus Radio on page 133 refrain from price quotations. Why all this secrecy? Are manufacturers afraid they will scare off prospective customers?

It is my belief that if suggested prices were once again part of the ad, a better comparison could be made by the reader. Also, I feel that some prospects are turned away because they "think" a piece of gear is more expensive than it actually is.

I would like to see price of equipment on each and every piece of gear that is advertised to the ham market. This does not mean that the prices would have to be firm. Everybody knows that individual dealers can make their own deal within the limits of sound business practice, so why not give the consumer a few guidelines?

Generally speaking, a dealer in amateur equipment will sell more than one product line. For example, a given jobber will sell both Kenwood and Icom. If he can vary from the suggested list price on Kenwood, he can do the same on Icom. The buyer can decide which rig he wants, assuming they both cost the same, judging strictly by product performance. Assuming there is a vast difference in price, he can decide whether the additional features are worth the additional cost.

A couple of years ago I sold my 1971 Vega. I put a "For Sale" sign on it along with the price and parked it in my driveway. Anybody who called already knew how much I was asking for the car. What they wanted to know was the particulars of the car itself.

About the same time, my friend sold his car. He failed to put the price on the "For Sale" sign. He got a lot of calls, but the first question was always "how much?" The answer was usually "too much." In this case, not listing the price turned away prospective buyers.

If all the ads in *73* had prices listed, I, for one, would be relieved of all kinds of doubt. That's all I have to say.

Ken Piletic W9ZMR
Streamwood IL

THE BYTE DEBACLE

Just read your December editorial: Someone doesn't like any part of computers, they want to keep *73* purely ham radio oriented. Fine, but there is at least one other side.

Wayne, I got the call W6ESV in 1948 and hammed to beat the devil for a few years; then gradually it pooped out. But doggone it, this computer technology has brought me out of the woodwork.

For the first time in years, I am excited about electronics again; my dream of a coat pocket portable QRP rig will get some more attention, but mostly I am plunging into the computer part right now. In the next few weeks, I'll be getting a simple system and putting it on the air as my subscription service computer, but that's only the excuse. I really want to get in there and have a lot of fun with that rascal whenever we are not running labels.

But you should know that it was *73* which was responsible for this change in me and *Byte* before that. I had liked that magazine, but the change in staff slipped by me until the editorial treatment got too far away from what I've come to think of as Green style. I discovered then that you were filling the gap which had begun to exist for me with the I/O pages of *73*, so I switched. Your hints in the editorial say there is something less than a perfect relationship between you and *Byte*.

What happened? Was it a property settlement as a result of divorce, did someone beat you out of it . . . what happened? If divorce, there are probably one or two of us out here who've been through it so you can use the word out loud and not shock us. If otherwise, get some code words together; we who read you a lot will read through. Point is, lots of people

Continued on page 116

I/O REPORT

by John Craig

On November 14, 1976, a friend of mine and I loaded my station wagon up with all of the "junk" we've accumulated over the last few years and headed off to the local swap meet. That evening we returned with 95% of all the "junk" we've accumulated over the last few years. The problem, which we suffered through all that day, was simply that the people who came to that swap meet didn't appreciate all the fine electronic and computer goodies we had to offer. In a rare stroke of brilliance, I came up with a solution. Why not hold a swap meet just for electronic enthusiasts, hams, and computer hobbyists? So I did. And it was neat!

Now, most hams are familiar with the "problem" I mentioned (regarding conventional swap meets), and that's why they save their stuff to sell at hamfests. But I think I may have come up with some ideas for turning people on to computers and ham radio, also. At first I was thinking small and started off by asking the members of our local computer club (during a meeting) if they would be interested in having a swap meet. Every hand in the room went up. Then I thought of all the other clubs in the area, the stores, the hams, and the electronic experimenters. If you're going to do something like this, it doesn't take that much more effort to do it right! So ... I simply ran off some flyers on the ol' mimeograph machine and proceeded to mail them out to all the stores (computer stores, ham radio dealers, Lafayette, Radio Shack, etc.) and clubs. One of the most significant things I did to spread the word was tell some of my ham friends about it. Two meters was really jumping with the word! The swap meet was held on December 11, 1976.

I had three objectives in putting together *The First Annual Central California Electronic/Computer Hobbyists Swap Meet.* Number one, I wanted to sell all of that "junk" I mentioned earlier (only now, I needed to sell it to pay for the expense of putting on the shindig, and the $2.50 seller's fee didn't help much). Number two, I wanted to get a lot of people with common interests together for a good time. What a success that was! Number three, I had hoped to get some newcomers turned on to computers. I arranged to have several computers up and running with the idea of attracting the attention, and interest, of those who had never seen a home system before. Although we did manage to snare two or three newcomers ... I didn't view that particular aspect of the operation as a major success. And I've got some ideas on how to improve it.

News? We need input, and one of the best sources is the club newsletter. Got one? We reiterate our longstanding offer of a free subscription to 73 or Kilobaud *in exchange for a spot on your ham or computer club newsletter mailing list. Deal?*

First of all, I think something like this should be put on by a ham radio or computer club (instead of an individual). Notices about the clubs and when they meet should be displayed at the swap meet, too. It could be a good fund-raising project if, for example, everyone donated a certain percentage of their proceeds to the club. But I really think one of the most important objectives should be to try to introduce personal computers to as many people as possible. It's going to be necessary to make sure the laymen of the community hear about your affair and are attracted to it, but it's going to be just as important to make sure that some worthwhile demonstrations are set up.

In retrospect, I feel I should have set one whole area of the room aside for personal systems demonstrations (instead, I had two or three demo systems scattered around). These systems need to be doing *something* besides playing games. Now don't get me wrong (I have plenty of games on my home system ... and we all enjoy them very much). I think games are fine as far as getting someone's attention in a situation like this goes, but if that's *all* they see, you can hardly blame them for walking away shaking their heads and wondering why anyone would shell out over a thousand bucks for a "game player." No — more is needed. Some educational programs should be up and running ... demonstrations of how the computer works in a home security system ... ham radio demonstrations ... recipe file and modification programs ... home accounting ... etc. And, a real biggee would be to have some small business programs going ... or at least some small routines which would demonstrate what the computer could do *if* the software were finished. Just having the computer print out statements for use in billing is quite impressive (especially when you tell people that the response time and willingness to pay is substantially increased when computer-generated invoices are sent out — customers don't want to get a bad rating "in the computer system").

The prime objective of this whole thing is to hold a computer/ham/electronics swap meet. Therefore, you're going to be trying to attract people with those interests (which won't be hard) and they will be the easiest to get interested in computers and ham radio. But why not try to get others to come out and see what personal computer systems and hamming are all about? Spreading the word through as many civic organizations (Lions, Rotary, etc.) as possible, along with classified ads, should go a long way in accomplishing the objective.

Along with having a computerized ham station, why not have another station (without a computer) set up and handling traffic (perhaps another local station could be generating dummy messages to eliminate inactive periods)? My gosh! Think of it! There would be CBers to convert, too! There aren't many ways I'd rather spend a Saturday than hanging around with a bunch of people who are as enthusiastic as I am about personal computers. Everyone really had a good time, and the general consensus was that it should definitely be a quarterly or semi-annual affair. Therefore, I think we'll do it again in May. (It was also suggested that more than two weeks notice might bring in more people and not having it so close to Christmas might loosen up the pocketbooks some.)

THE FIRST WEST COAST COMPUTER FAIRE

Last month I mentioned the possibilities for making an impact at this convention with amateur radio applications ... and this month we're going to take a look at some of the other areas the convention will be covering:

1) *Personal Computers for Education.* Kind of mind-boggling when you consider the immense area that topic covers ... from every grade school in the country up through junior high, high school, and college (and of course, let's not forget the home). Every school in the country could afford to have computers for teaching now. And, it would be just great if they would get rid of the ridiculous red tape that makes it so hard to get them!

2) *Computers and Systems for Very Small Businesses.* I'm going to be giving a talk in this area, and as you may have guessed from previous I/O Reports, it's one of my favorite subjects.

3) *Program and Data Input via Optical Scanning of Bar Coded Information.* Sounds like something some magazine should get behind and support. They might even run a series of articles on how it works and how programs can be read directly into the computer from the magazine page. Hmmm ... an interesting idea. I'll have to look into that. (In all seriousness, I think it's a fascinating idea, and I'm looking forward to seeing how it develops. There are other interesting — and super inexpensive — methods of getting data into our home systems ... and I'm looking forward to their development, also. Would you believe using the home phonograph and a 33-1/3 LP record which has your library of games, applications programs, language processors, and anything else prerecorded on it?)

MISCELLANEOUS

At a recent meeting of our local computer club, the president took a survey of the members to see who was subscribing to which of the various hobby computer magazines. At the conclusion, someone asked, "Hey, what about *73*?" (It was on the list ... he just hadn't asked about it.) Well, folks, I'm happy to report that *73* polled the highest of them all!

WATCH FOR 73's "THE NEW COMPUTERS"!

Louis I. Hutton K7YZZ
12235 S.E. 62nd St.
Bellevue WA 98006

How to Use Those Old Teletypes

-- computer operation with a 60 mA machine

Several months ago I purchased an 8080-4BD microcomputer kit from The Digital Group and described my efforts in assembling and testing the unit in *73 Magazine*. During the period of getting acquainted with the Tiny BASIC Extended program that is supplied by The Digital Group Software Systems, I determined that what I needed was some way to make a hard copy of those programs I had so laboriously keyed into the machine's memory. Being able to store them on a cassette tape was fine, but what I needed was a method of writing them out on paper so that I could look them over and find the bugs and note changes. I also wanted a means of making a hard copy of the Biorhythm program output that is available in cassette form from The Digital Group Software Systems. The original tape just displayed only 14 days on the TV readout. I wanted to make a hard copy of the graph plot and run it for any length of time selected by the operator.

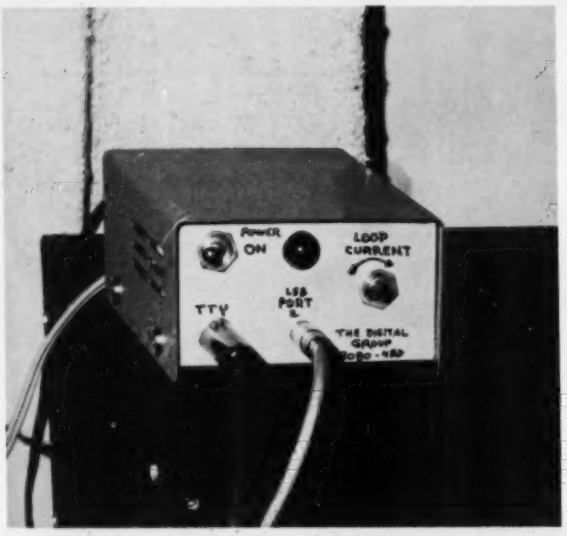
After several lengthy phone calls to Dr. Suding of The Digital Group, a new cassette program was released that is called Biorhythm Baudot. This program permits the operator to run the Biorhythm plot both on the TV screen and on a TTY machine, providing it is properly interfaced to the computer. The program also provides the operator with a capability of printing out programs that have been written in Tiny BASIC Extended. The results of some of the games that are available to The Digital Group equipment users may also be printed out on the TTY machine. The following article is a description of the interface unit I built to use with my 8080-4BD microcomputer, and how I use it to print out listings of my programs and Biorhythm charts.

Circuit Description

The circuit as shown in Fig. 1 consists of a loop power supply and a transistor driver circuit to permit the computer to drive a TTY machine. This unit is designed to stand alone and does not require any external dc loop supply for the TTY machine. The loop current adjust control is adjusted for a loop current of about 60 mA. I have found it will key the machine with as low as 30 mA without errors. The TTL logic signal from output port #2 LSB feeds a high voltage switching transistor, which in turn keys the TTY loop supply and keys the magnets on the machine. The IN-4005 across the output of the transistor is to keep transient spikes from causing troubles in the circuit.

Construction

The unit shown in the photographs is built in a



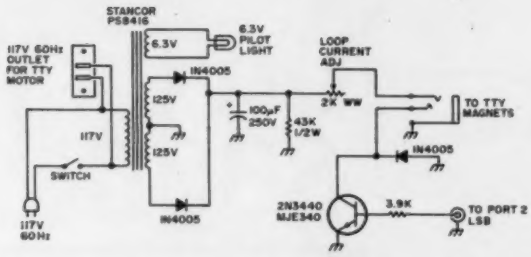


Fig. 1. TTY interface unit: The Digital Group 8080-4BD to Model 15/28.

Radio Shack equipment cabinet #270-252. It is 4" wide by 2-3/8" high by 6" deep. The outlet connector for the TTY motor power is mounted on the back of the cabinet chassis, along with the power cord fitting. The transformer is bolted to the back flange of the chassis. The filter capacitor is strap-mounted to the bottom of the chassis. The front panel is fitted with the power switch, loop circuit jack, port #2 LSB connector, pilot light, and loop current adjustment control.

Operation

The unit installed with the equipment is shown in the overall photo view of the microcomputer system at K7YZZ. It is seen sitting on top of the left-hand side of the computer unit, just above the computer power outlets. A twisted pair shielded cable is run from the TTY output connector to the selector magnets of my Model 28 KSR. The power cable from the Model 28 KSR is plugged into the rear of the interface unit. A single conductor shielded cable is run from the output port #2 LSB to the jack on the front of the unit.

To put the unit into operation, the microcomputer system is initialized with the Biorhythm Baudot cassette tape recording and the power on the interface unit is then turned on. The TTY machine motor is turned on and, if a run of Biorhythm is desired, the operator keys in 6 on the keyboard and then keys in RUN. The TTY machine will then begin to print out the Biorhythm instructions. The TV screen will also print out the same information at the same speed as the TTY machine. It should be noted that the system is set for a 60 speed machine. If the operator desires a listing of more than 14 days, the statement at 073 must be changed to give the desired number of days to run. For example, it would read 073 LET P = 60. This would make the TTY machine print out 60 days' worth of Biorhythm data.

If the operator desires to use the loading as a TTY readout of a program, then he should hit the RESET button and key in 6. Typing in the word NEW will erase the Biorhythm data from the memory but will leave the Baudot output undisturbed. Now the operator may key in or cassette load any program in Tiny BASIC Extended format. When finished, a listing of that program may be obtained on the TTY machine by typing in LST, and keying the RETURN button on the keyboard. This will cause the system to begin typing out a listing of the program entered into the memory from the keyboard or cassette. I usually set my TTY machine on double space during a listing run. This provides sufficient space between each line to make corrections to the program.

In attempting to play some of the games that are available from The Digital Group Software Systems, I have found that if the program's listing includes any TAB (0) statements, they must be deleted before they are run on the TTY machine. A TAB (0) statement makes the TTY machine print 16 lines of blank spaces and wastes time and paper. It is used in the computer mode to clean the TV screen and works fine there, but it is too slow on TTY.

Conclusion

This little unit works very nicely with the 8080-4BD system, and has been most useful in getting a good copy of the program listings for bug shooting. My friends have also really appreciated the fine Biorhythm runs I have made on the TTY machine. ■

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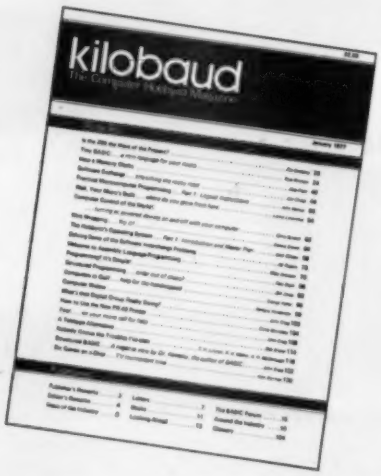

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75-40 HD (SP)	75/40	57.50	40/1.12	66/20.1
75-20 HD	75/40/20	66.50	44/1.23	66/20.1
75-20 HD (SP)	75/40/20	66.50	44/1.23	66/20.1
75-10 HD	75/40/20/15/10	74.50	48/1.34	66/20.1
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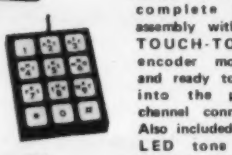

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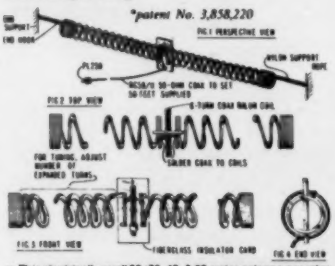

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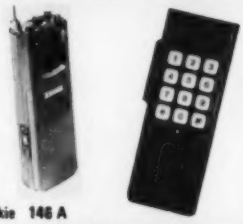

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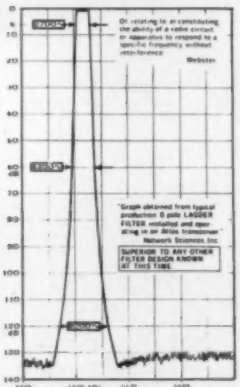
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Field trimmable radiator permits quarter wave operation on any frequency from 140 to 500 MHz. Cutting chart included. Complete with trunk lip mount, 17' RG-58-U and PL-259. **Price: $16.85**

STAINLESS STEEL BALL MOUNT FOR DECK, FENDER OR ANY FLAT SURFACE
MODEL SSM-2
Heavy 2" reinforced stainless steel 180° adjustable ball mount easily supports any antenna mobile whip. Includes cycolac base, steel back-up plate and mounting hardware.
Price: $19.20

QUICK DISCONNECT—100% STAINLESS STEEL
MODEL QD-1
Remove antenna from mount with easy press and twist release. Compression spring and all parts 100% stainless steel. ¾"-24 threads—female one end, male the other.
Price: $16.95

FEED LINE MODEL L-54-240
Get known performance, maximum signal strength for minimum noise pick-up on this SPEC 58 length of RG-58-U cable. Supplied with connectors attached for use with ball or bumper mount and transceiver.
Price: $8.50

MODEL GS-144A — Deluxe, two-Meter Colinear for Repeater or any fixed station operation. 6 db gain over a ½ wave dipole. Maximum radiation at the horizon! Shunt fed with D.C. grounding. Radiator, ½ wave lower section, ¼ wave phasing, ½ wave upper section. Height: 117". SWR at resonance: 1.2:1 or better. Power rating: 1,000 Watts FM. Wind survival: 100 MPH. Installs on vertical pipe up to 1½" O.D. SO-239 coax connector
Price: $67.85

MODEL C-M
Ball mount complete with mounting hardware.
Price: $8.20

HUSTLER RESONATORS

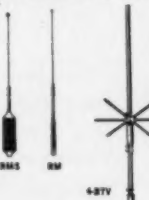
All resonators are precision wound with optimized design for each band. Assembly includes 17-7 PH stainless steel adjustable tip rod for lowest SWR and band edge marker. Choose for medium or high power operation.

STANDARD HUSTLER RESONATORS—
Power Rating: 400 watts SSB

Model	Band	Price
RM-10	10 meters	$10.75
RM-15	15 meters	$11.75
RM-20	20 meters	$12.75
RM-40	40 meters	$13.85
RM-75	75 meters	$16.95
RM-80	80 meters	$16.95

SUPER HUSTLER RESONATORS—
Power Rating: Legal Limit SSB
Supports base widest bandwidth

Model	Band	Price
RM-10-S	10 meters	$13.95
RM-15-S	15 meters	$15.95
RM-20-S	20 meters	$19.70
RM-40-S	40 meters	$23.50
RM-75-S	75 meters	$28.95
RM-80-S	80 meters	$28.95



Covers 10 - 15 - 20 - 40 Meters
Only Hustler Gives One Setting for Whole Band Coverage

MODEL 4-STV
- Lowest SWR—PLUS.
- Bandwidth at its broadest! SWR 1.6 to 1 or better at band edges.
- Hustler exclusive trap covers "Spiritz" extruded to otherwise unobtainable close tolerances assuring accurate and permanent trap resonance.
- Solid one inch fiberglass trap forms for optimum electrical and mechanical stability.
- Extra heavy duty aluminum mounting bracket with low loss — high strength insulators. Mounting hardware included.
- All sections 1¼" heavy wall, high strength aluminum.
- Stainless steel clamps permitting adjustment without damage to the aluminum tubing.
- Guaranteed to be easiest assembly of any multi-band vertical.
- Antenna has ¾"-24 stud at top to accept RM-75 or RM-75-S Hustler resonator for 75 meter operation when desired.
- Top loading on 75 meters for broader bandwidth and higher radiation efficiency!
- Feed with any length 50 ohm coax.
- Power capability—full legal limit on SSB or CW.
- Mounting: Ground mount with or without radials, or roof mount with radials.

Length: 21' 9"
MODEL 4-MTV
Weight: 15 lbs.
Price: $99.95

For 8 - 10 - 15 - 20 - 40 - 75 - 80 Meters

Fold over mast for quick and easy interchange of resonators or entering a garage. When operating, mast is held vertical with shakeproof sleeve clutch. 96" mast also serves as 1/4 wave length 6 meter antenna. Stainless steel base has ¾"-24 threads to fit mobile ball mount or bumper mount.

HUSTLER MASTS
The Majority Choice of Amateurs Throughout the World!

MODEL MO-2
For bumper mounting—Fold is at roof line 27" above base. **Price: $22.00**

MODEL MO-1
For deck or fender mounting—Fold is at roof line 19" above base. **Price: $22.00**

MO-1 MO-2

SUPER AMP from DenTron

$499.50

If the amplifier you're thinking of buying doesn't deliver at least 1000 to 1200 watts output, to the antenna, you're buying the wrong amplifier.

Our New Super Amp is sweeping the country because hams have realized that the DenTron Amplifier will deliver to the antenna, (output power), what other manufacturers rate as input power.

The Super Amp runs a full 2000 watts P.E.P. input on SSB, and 1000 watts DC on CW, RTTY or SSTV 160-10 meters, the maximum legal power.

The Super Amp is compact, low profile, has a solid one-piece cabinet assuring maximum TVI shielding.

The heart of our amplifier, the power supply, is a continuous duty, self-contained supply built for contest performance.

We mounted the 4 - 811 A's, industrial workhorse tubes, in a cooling chamber featuring the on-demand variable cooling system.

The hams at DenTron pride themselves on quality work, and we fight to keep prices down. That's why the dynamic DenTron Linear Amplifier beats them all at $499.50.

NOW AVAILABLE WITH 572 B's FOR **$574.50**

DenTron

Match everything from 160 to 10 with the new 160-10 MAT

NEW: The Monitor Tuner was designed because of overwhelming demand. Hams told us they wanted a 3 kilowatt tuner with a built-in wattmeter, a front panel antenna selector for coax, balanced line and random wire. So we engineered the 160-10m Monitor Tuner. It's a lifetime investment at $299.50.

$299.50

Meet the SuperTuner

The DenTron Super Tuner tunes everything from 160-10 meters. Whether you have balanced line, coax cable, random or long wire, the Super Tuner will match the antenna impedance to your transmitter. All DenTron tuners give you maximum power transfer from your transmitter to your antenna, and isn't that where it really counts?

1 KW MODEL **$129.50** 3 KW MODEL **$229.50**

DenTron

The 80-10 Skymatcher

Here's an antenna tuner for 80 through 10 meters, handles 500 w P.E.P. and matches your 52 ohm transceiver to a random wire antenna.

- Continuous tuning 3.2 - 30 mc
- "L" network
- Ceramic 12 position rotary switch
- 80—239 receptional to transmitter
- Random wire tuner
- 3000 volt capacitor spacing
- Tapped inductor
- Ceramic antenna feed thru
- 7" W. 5" H. 8" D., Weight: 5 lbs.

$59.50

Read forward and reflected watts at the same time

Tired of constant switching and guesswork?

Every serious ham knows he must read both forward and reverse wattage simultaneously for that perfect match. So upgrade with the DenTron W-2 Dual in line Wattmeter.

$99.50

DenTron

The Sky Openers

SKYMASTER

A fully developed and tested 27 foot vertical antenna covers entire 10, 15, 20, and 40 meter bands using only one cleverly applied wave trap. A full 1/4 wave antenna on 20 meters. Constructed of heavy seamless aluminum with a factory tuned and sealed HQ Trap, SKYMASTER is weatherproof and withstands winds up to 80 mph. Handles 2 KW power level and is for ground, roof or tower mounting. Radials included in our low price of

$84.50

Also 80 m resonator for top mounting on SKYMASTER.

$29.50

SKYCLAW

A tunable monoband high performance vertical antenna, designed for 40, 80, 160 meter operation. SKYCLAW gives you the following spectrum coverage:

BAND (Meters)	BANDWIDTH (kHz)
160	50
80	200
40	entire band

Tuning is easy and reliable. Rugged construction assures that this self-supporting unit is weatherproof and survives nicely in 100 mph winds.. Handles full legal power limit.

$79.50

EX-1

The DenTron EX-1 Vertical Antenna is designed for the performance minded antenna experimenter. The EX-1 is a full 40 meter, ¼ wave, 33', self-supporting vertical. The EX-1 is the ideal vertical for phasing.

$59.50

TRIM-TENNA

The antenna your neighbors will love. The new DenTron Trim-Tenna with 20 meter beam is designed for the discriminating amateur who wants fantastic performance in an environmentally appealing beam. It's really loaded! Up front there's a 13 foot 6 inch director with precision Hy-Q coils. And, 7 feet behind is a 16 foot driven element fed directly with 52 ohm coax. The Trim-Tenna mounts easily and what a difference in on-the-air performance between the Trim-Tenna and that dipole, long wire or inverted Vee you've been using. 4 & 6 Forward Gain Over Dipole.

$129.50

ALL BAND DOUBLET

This All Band Doublet or inverted Type Antenna covers 160 thru 10 meters. Has total length of 130 feet (14 ga. stranded copper) although it may be made shorter if necessary. This tuned Doublet is center fed through 100 feet of 450 ohm PVC covered balanced transmission line. The assembly is complete. Add rope to the ends and pull up into position. Tune with the DenTron Super Tuner and you're on 10 through 160 meters with one antenna! Now just for the DenTron All Band Doublet.

$24.50

DenTron

TUFTS RADIO CATALOG — TUFTS RADIO

TUFTS RADIO CATALOG TUFTS RADIO

vhf engineering

THE WORLD'S MOST COMPLETE LINE OF VHF-FM KITS AND EQUIPMENT

RECEIVERS

RX28C	28-35 MHz FM receiver with 2 pole 10.7 MHz crystal filter	59.95
RX50C Kit	30-60 MHz rcvr w/2 pole 10.7 MHz crystal filter	59.95
RX144C Kit	140-170 MHz rcvr w/2 pole 10.7 MHz crystal filter	69.95
RX144C W/T.	same as above – factory wired and tested	114.95
RX220C Kit	210-240 MHz rcvr w/2 pole 10.7 MHz crystal filter	69.95
RX220C W/T	same as above – factory wired and tested	114.95
RX432C Kit	432 MHz rcvr w/2 pole 10.7 MHz crystal filter	79.95
RXCF	accessory filter for above receiver kits gives 70 dB adjacent channel rejection	8.50

RF28 Kit	10 meter RF front end 10.7 MHz output	12.50
RF50 Kit	6 meter RF front end 10.7 MHz output	12.50
RF144D Kit	2 meter RF front end 10.7 MHz output	17.50
RF220D Kit	220 MHz RF front end 10.7 MHz output	17.50
RF432 Kit	432 MHz RF front end 10.7 MHz output	27.50
IF 10.7F Kit	10.7 MHz IF module includes 2 pole crystal filter	27.50
FM455 Kit	455 KHz IF stage plus FM detector	17.50
AS2 Kit	audio and squelch board	15.00

TRANSMITTERS

TX144B Kit	transmitter exciter – 1 watt – 2 meters	$ 29.95
TX144B W/T.	same as above – factory wired and tested	49.95
TX220B Kit	transmitter exciter – 1 watt – 220 MHz	29.95
TX220B W/T.	same as above – factory wired and tested	49.95

TX432B Kit.	transmitter exciter 432 MHz	39.95
TX432B W/T	same as above - factory wired and tested	59.95
TX150 Kit	300 milliwatt, complete 2 meter transmitter, less crystal and mike	19.95

POWER AMPLIFIERS

PA2501H Kit	2 meter power amp – kit 1 w in – 25w out with solid state switching, case, connectors	59.95
PA2501H W/T	same as above – factory wired and tested	74.95
PA4010H Kit	2 meter power amp – 10w in – 40w out – relay switching	59.95
PA4010H W/T	same as above – factory wired and tested	74.95
PA144/15 Kit	2 meter power amp – 1w in – 15w out – less case, connectors and switching	39.95

PA144/25 Kit	similar to PA144/15 kit except 25w out	49.95
PA220/15 Kit	similar to PA144/15 for 220 MHz	39.95
PA432/10 Kit	power amp – similar to PA144/15 except 10w and 432 MHz	49.95
PA140/10	10w in – 140w out – 2 meter amp – factory wired and tested	179.95
PA140/30	30w in – 140w out – 2 meter amp – factory wired and tested	159.95

POWER SUPPLIES

PS15C Kit	15 amp – 12 volt regulated power supply w/case, w/fold-back current limiting and overvoltage protection	79.95
PS15C W/T	same as above – factory wired and tested	94.95
PS25C Kit	25 amp – 12 volt regulated power supply w/case, w/fold-back current limiting and overvoltage protection	129.95
PS25C W/T	same as above – factory wired and tested	149.95

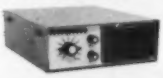
O.V.P.	adds over voltage protection to your power supplies, 15 VDC max	9.95
PS3A Kit	12 volt – power supply regulator card with fold back current limiting	8.95
PS3012	new commercial duty 30 amp 12 VDC regulated power supply w/case, w/foldback current limiting and over voltage protection, wired and tested	239.95

REPEATERS

RPT28 Kit	repeater – 10 meter	TBA
RPT28	repeater – 10 meter, wired & tested	TBA
RPT50 Kit	repeater – 6 meter	TBA
RPT50	repeater – 6 meter, wired & tested	TBA
RPT144 Kit	repeater – 2 meter – 15w – complete (less crystals)	465.95
RPT220 Kit	repeater – 220 MHz – 15w – complete (less crystals)	465.95
RPT432 Kit	repeater – 10 watt – 432 MHz (less crystals)	515.95

RPT144	repeater – 15 watt – 2 meter – factory wired and tested	695.95
RPT220	repeater – 15 watt – 220 MHz – factory wired and tested	695.95
RPT432	repeater – 10 watt – 432 MHz – factory wired and tested	749.95
DPLX144	2 meter, 600 KHz spaced duplexer, wired and tuned to frequency	399.95
DPLX220	220 MHz duplexer, wired and tuned to frequency	399.95

TRANSCEIVERS



TRX 144 Kit	case and all components to build 15 watt 10 channel scanning 2 meter transceiver (less mike and crystals)	219.95
TRX 220 Kit	same as above except for 220 MHz	219.95
TRX 432 Kit	same as above except 10 watt and 432MHz	254.95

SYNTHESIZERS

SYN II Kit	2 meter synthesizer, transmit offsets programmable from 100 KHz - 10 MHz, (Mars offsets with optional adapters)	169.95
SYN II	same as above, wired and tested	239.95

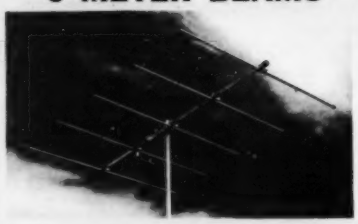
WALKIE TALKIES

HT 144B Kit.	2 meter, 2w, 4 channel, hand held receiver with crystals for 146.52 simplex	129.95
NICAD	battery pack, 12 VDC, ½ amp	29.95
NICAD	battery charger	5.95
Rubber Duck	2 meter, with male BNC connector	8.95

OTHER PRODUCTS BY VHF ENGINEERING

CD1 Kit	10 channel receive xtal deck w/ diode switching	6.95
CD2 Kit	10 channel xmit deck w/switch and trimmers	14.95
CD-3 Kit	UHF version of CD-1 deck, needed for 432 multi-channel operations	12.95
COR2 Kit	complete COR with 3 second and 3 minute timers	19.95
SC3 Kit	10 channel auto-scan adapter for RX with priority.	19.95
Crystals	we stock most repeater and simplex pairs from 146.0-147.0 (each)	5.00
CWID Kit	159 bit, field programmable, code identifier with built-in squelch tail and ID timers	39.95
CWID	wired and tested, not programmed	54.95
CWID	wired and tested, programmed	59.95
Microphone	2,000 ohm dynamic mike with P.T.T. and coil cord	9.95

6 METER BEAMS



3 - 5 - 6 - 10 ELEMENTS

Proven performance from rugged, full size, 6 meter beams. Element spacings and lengths have been carefully engineered to give best pattern, high forward gain, good front to back ratio and broad frequency response.

Booms are .058 wall and elements are 3/4" - 5/8" .049 wall seamless chrome finish aluminum tubing. The 3 and 5 element beams have 1 3/8" - 1 1/4" booms. The 6 and 10 element beams have 1 5/8" - 1 1/2" booms. All brackets are heavy gauge formed aluminum. Bright finish cad plated ubolts are adjustable for up to 1 5/8" mast on 3 and 5 element and 2" on 6 and 10 element beams. All models may be mounted for horizontal or vertical polarization.

New features include adjustable length elements, kilowatt Reddi Match and built-in coax fitting for direct 52 ohm feed. These beams are factory marked and supplied with instructions for quick assembly.

Description	3 element	5 element	6 element	10 element
Model No.	A50 3	A50 5	A50-6	A50 10
Boom Lngth	6'	12'	20'	24'
Longest El.	117"	117"	117"	117"
Turn Radius	6'	7' 6"	11'	13'
Fwd. Gain	7.5 dB	9.5 dB	11.5 dB	13 dB
F/B Ratio	20 dB	24 dB	26 dB	26 dB
Weight	7 lbs.	11 lbs.	18 lbs.	25 lbs.

new
RINGO RANGER for FM

4.5 dB* — 6 dB**
Omnidirectional GAIN BASE STATION ANTENNAS

FOR MAXIMUM PERFORMANCE AND VALUE

Cush Craft has created another first by making the world's most popular 2 meter antenna twice as good. The new Ringo Ranger is developed from the basic AR-2 with three half waves in phase and a one eighth wave matching stub. Ringo Ranger gives an extremely low angle of radiation for better signal coverage. It is tunable over a broad frequency range and perfectly matched to 52 ohm coax.

ARX-2, 137-160 MHz, 4 lbs., 112"
ARX-220, 220-225 MHz, 3 lbs., 75"
ARX-450, 435-450 MHz, 3 lbs., 39"

* Reference ½ wave dipole.
** Reference ¼ wave whip used as gain standard by many manufacturers.

Work full quieting into more repeaters and extend the radius of your direct contacts with the new Ringo Ranger.

You can up date your present AR-2 Ringo with the simple addition of this extende. kit. The kit includes the phasing network and necessary element extensions. The only modifications required are easy to make saw slits in the top section of your antenna.

ARX-2K CONVERSION KIT

2 METER ANTENNAS FM

A-FM RINGO 2.75 dB Gain (reference ¼ wave whip). Half wave length antennas with direct dc ground, 52 ohm feed takes PL-259, low angle of radiation with 1-1 SWR. Factory preassembled and ready to install. 6 meter partly preassembled, all but 450 MHz take 1¼" mast. There are more Ringos in use than all other FM antennas mentioned.

Model Number	AR-2	AR-25	AR-6	AR-220	AR-450
Frequency MHz	135-175	135-175	50-54	220-225	440-460
Power—Max. Watts	500	200	100	100	250
Wind area sq. ft.	.31'	.31'	.31'	.29'	.10'

5-4 POLE Up to 9 dB Gain over a ½ wave dipole. Overall antenna length 147 MHz — 32' 220 MHz — 15', 435 MHz — 9', pattern 360° — 6 dB gain, 180° — 9 dB gain, 52 ohm feed takes PL 259 connector. Package includes 4 complete dipole assemblies on mounting booms, harness and all hardware. Vertical support mast not supplied.

AFM-4D 144 - 150 MHz, 1000 watts, wind area 2.58 sq. ft.
AFM-24D 220 - 225 MHz, 1000 watts, wind area 1.86 sq. ft.
AFM-44D 435 - 450 MHz, 1000 watts, wind area 1.13 sq. ft.

D-POWER PACK The big signal 422 element array: for 2 meter FM, uses two A147-11 yagis with a horizontal mounting boom, coaxial harness and all hardware. Forward gain 16 dB, F/B ratio 24 dB, ½ power beamwidth 42°, dimensions 144" x 80" x 40", turn radius 60", weight 15 lbs., 52 ohm feed takes PL-259 fitting.

A147-22 146 - 148 MHz, 1000 Watts, wind area 2.42 sq. ft.

D-YAGI STACKING KITS VPK includes horizontal mounting boom, harness, hardware and instructions for two vertically polarized yagis gives 3 dB gain over the single antenna.

A14-VPK.	complete 4 element stacking kit
A14-SK.	4 element coax harness only
A147-VPK.	complete 11 element stacking kit
A147-SK.	11 element coax harness only
A449-SK.	6 + 11 element coax harness only

F-4-6-11 ELEMENT YAGIS The standard of comparison in VHF-UHF communications, now cut for FM and vertical polarization. The four and six element models can be tower side mounted. All are rated at 1000 watts with direct 52 ohm feed and PL-259 connectors.

Model Number	A147-11	A147-4	A449-11	A449-6	A220-11
Boom Longest ele.	144" 40"	44" 40"	60" 12"	35" 36"	102" 26"
Wght./Turn radius	6 lbs., 72"	3 lbs., 44"	4 lbs., 60"	3 lbs., 18"	5 lbs., 51"
Gain F. B ratio dB	13.2 28	9 20	13.2 28	11 20	13.2 28
½ Power beam	45°	66°	45°	66°	45°
Wind area sq. ft.	1.31	.43	.39	.50	.50
Frequency MHz	146-148	146-148	440-450	440-450	220-225

F-FM TWIST 12.4 dB Gain: Ten elements horizontal polarization for low end coverage and ten elements vertical polarization for FM coverage. Forward gain 12.4 dB, F/B ratio 22 dB, boom length 130", weight 10 lbs., longest element 80", 52 ohm Reddi Match driven elements take PL-259 connectors, uses two separate Feed lines.

A147-20T 145 - 147 MHz, 1000 watts, wind area 1.42 sq. ft.

HIGH PERFORMANCE VHF YAGIS

3/4, 1-1/4, 2 METER BEAMS

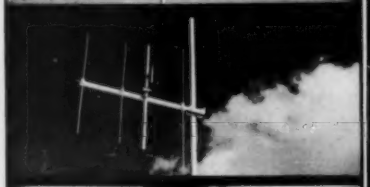
The standard of comparison in amateur VHF/UHF communications Cush Craft yagis combine all out performance and reliability with optimum size for ease of assembly and mounting at your site.

Lightweight yet rugged, the antennas have 3/16" O.D. solid aluminum elements with 5/16" center sections mounted on heavy duty formed brackets. Booms are 1" and 7/8" O.D. aluminum tubing. Mast mounts of 1/8" formed aluminum have adjustable u-bolts for up to 1-1/2" O.D. masts. They can be mounted for horizontal or vertical polarization. Complete instructions include data on 2 meter FM repeater operation.

New features include a kilowatt Reddi Match for direct 52 ohm coaxial feed with a standard PL-259 fitting. All elements are spaced at .2 wavelength and tapered for improved bandwidth.

Model No.	A144 7	A144 11	A220 11	A430 11
Description	2m	2m	1¼m	¾m
Elements	7	11	11	11
Boom Lngth.	98"	144"	102"	57"
Weight	4	6	4	3
Fwd. Gain	11 dB	13 dB	13 dB	13 dB
F/B Ratio	26 dB	26 dB	26 dB	26 dB
Fwd. Lobe @ ½ pwr. pt.	66	42	42	42
SWR @ Freq.	1 to 1	1 to 1	1 to 1	1 to 1

cushcraft CORPORATION



VHF/UHF BEAMS

A50-3	$ 27.50	A144-7	19.95
A50-5	39.50	A144-11	24.95
A50-6	59.50	A430-11	19.95
A50-10	89.50		

AMATEUR FM ANTENNAS

A147-4	$ 15.95	AFM-44D	47.50
A147-11	24.95	AR-2	18.50
A147-20T	47.50	AR-6	24.50
A147-22	69.50	AR-25	21.50
A220-7	18.95	AR-220	18.50
A220-11	22.95	AR-450	18.50
A449-6	15.95	ARX-2	28.50
A449-11	21.95	ARX-2K	11.95
AFM-4D	53.50	ARX-220	28.50
AFM-24D	49.50	ARX-450	28.50

Send SASE for a reprint of this catalog!

TUFTS RADIO CATALOG TUFTS RADIO

why waste watts?

SWR-1 guards against power loss for $21.95

If you're not pumping out all the power you're paying for, our little SWR-1 combination power meter and SWR bridge will tell you so. You read forward and reflected power simultaneously, up to 1000 watts RF and 1:1 to infinity VSWR at 3.5 to 150 MHz.

Got it all tuned up? Keep it that way with SWR-1. You can leave it right in your antenna circuit.

SWAN® ELECTRONICS
A subsidiary of Cubic Corporation

DELUXE 742 TRI-BAND MOBILE ANTENNA

- Automatically adjusts to proper resonance for 20, 40 and 75 meters.
- Power rated at 500 Watts P.E.P.
- Includes base section, automaticoil and whip top section. 742 Antenna $79.95

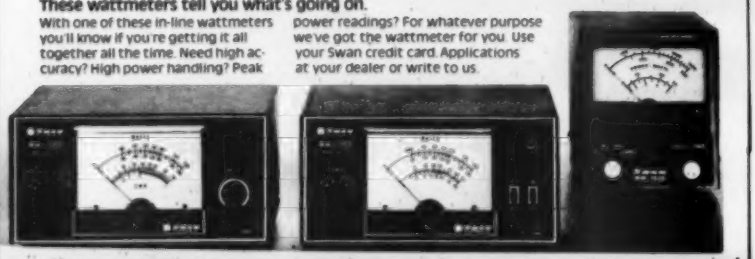
EXCLUSIVE DELUXE 5-BAND MOBILE 45 ANTENNA

- All band manual switching antenna for 10, 15, 20, 40 and 75 meters.
- Power rated at 1000 Watts P.E.P.
- Includes base section with mobilecoil and six foot whip top section. 45 Antenna $114.95

SWAN METERS HELP YOU GET IT ALL TOGETHER

These wattmeters tell you what's going on.

With one of these in-line wattmeters you'll know if you're getting it all together all the time. Need high accuracy? High power handling? Peak power readings? For whatever purpose we've got the wattmeter for you. Use your Swan credit card. Applications at your dealer or write to us.



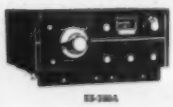
WM1000 In-Line Wattmeter With Muscle. Scales to 2000 watts. Near flat response/directional coupler for maximum accuracy. $49.95

WM1000 Peak-reading Wattmeter. Reads RMS power even with the flick of a switch: true peak power of your single-sideband signal. That's what counts on SSB. $64.95

WM1500 High Accuracy In-Line Wattmeter. 10% full scale accuracy on 5, 50, 500 and 1500 watt scales. 2 to 30 MHz. Forward and reflected power. Use it for trouble-shooting, too. $64.95

SWAN® ELECTRONICS

Hams the world over value amateur radio products from Swan Electronics. Among the most respected of these are the unique single-sideband rigs with that "special something" extra – like those illustrated here.



SWAN 55-200A Transceiver. Fully solid-state, unique broadband tuning on all five bands, and infinite VSWR protection. Maintains up to 300 watts P.E.P. input on any frequency selected. $799.95

SWAN LINEAR AMPLIFIERS A Mark II 2000 watt P.E.P. full legal input power unit or the 1200X matching Cygnet 1200 watt P.E.P. input powerhouse with built-in power supply. The choice is yours. $849.95

CYGNET 1200X PORTABLE LINEAR AMPLIFIER

To quadruple the output of the 300B Cygnet de novo, simply add this matching unit for more than a kilowatt of power. Complete with self-contained power supply and provision for external ALC, this Cygnet offers exceptionally high efficiency and linearity. $349.95

Additional Swan products include: fixed and mobile antennas, VFO's telephone patch, VOX, wattmeter, microphones and mounting kits. As another extra service, only Swan Electronics offers factory-backed financing to the amateur radio community. Visit an authorized Swan Electronics dealer for complete details or, if you prefer, write:

SWAN® ELECTRONICS

JMR MOBIL-EAR™

Two-way-radio headset with superior fidelity Electret-Capacitor boom microphone and palm-held talk switch.

$69.95

FOR BROADCAST-QUALITY TRANSMISSION AND RECEPTION FOR BOTH MOBILE UNITS AND BASE STATIONS.

- Boom-mounted electret-capacitor microphone delivers studio-quality, undistorted voice reproduction. Variable gain control lets you adjust for optimum modulation.
- Cushioned earcup lets you monitor in privacy – no speaker blare to disturb others. Blocks out environmental noises, too. Made of unbreakable ABS plastic.
- Headband self-adjusts for comfortable wear over long hours. Spring-flex hinge lets you slip headset on and off with just one hand. Reversible for right or left ear.
- Headset can be hung on standard microphone clip.
- Compact palm-held talk switch lets you keep *both* hands on the wheel for safer driving. Made of unbreakable ABS plastic.
- Built-in FET transistor amplifier adapts microphone output to any transceiver impedance.
- Compatible with most two-way radios including 40-channel CB units.
- Built-in Velcro pad for easy mounting of the talk switch.
- Made in U.S.A.

SPECIFICATIONS

Earphone impedance and type:	8 ohms, dynamic
Microphone type:	Electret capacitor
Microphone frequency response:	200–6000 Hz
Amplifier type:	FET transistor, variable gain
Amplifier battery power:	7-volt Mallory TR-175
Switching:	Relay or electronic

IDEAL FOR EVERY TWO-WAY RADIO COMMUNICATIONS NEED . . .

CB operators • Amateur radio operators • Police and fire vehicles • Ambulances and emergency vehicles • Taxis and truckers • Marine pleasure and work boats • Construction and demolition crews • Industrial communications • Security patrols • Airport tower and ground crews • Remote broadcast and TV-camera crews • Foresters and fire-watch units •

ARGONAUT #509

AMPLIFIER #405

TEN-TEC

ARGONAUT, MODEL 509
Covers all Amateur bands 10-80 meters. 9 MHz crystal filter. 2.5 kHz bandwidth. 1.7 shape factor @ 6/50 dB points. Power required 12-15 VDC @ 150 mA receive, 800 mA transmit at rated output. Construction: aluminum chassis, top and front panel, molded plastic end panels. Cream front panel, walnut vinyl top and end trim. Size: HWD 4½" x 13" x 7". Weight 6 lbs.

LINEAR AMPLIFIER, MODEL 405
Covers all Amateur bands 10-80 meters. 50 watts output power, continuous sine wave. RF wattmeter. SWR meter. Power required 12-15 VDC @ 8 A, max. Construction: aluminum chassis, top and front panel, molded plastic side panels. Cream front panel, walnut vinyl top and end trim. Size: HWD 4½" x 7" x 8". Weight 2½ lbs.

Argonaut, Model 509 ..... $329.00
Linear Amplifier, Model 405 ..... 159.00
Power Supply, Model 251
(Will power both units) 79.00
Power Supply, Model 210
(Will power Argonaut only) 27.50

The new ultra-modern fully solid-state TRITON makes operating easier and a lot more fun, without the limitations of vacuum tubes.

For one thing, you can change bands with the flick of a switch and no danger of off-resonance damage. And no deterioration of performance with age.

But that's not all. A superlative 8-pole i-f filter and less than 2% audio distortion, transmitting and receiving, makes it the smoothest and cleanest signal on the air.

The TRITON IV specifications are impeccable. For selectivity, stability and receiver sensitivity. And it has features such as *full* CW break-in, pre-selectable ALC, off-set tuning, separate AC power supply, 12 VDC operation, perfectly shaped CW wave form, built-in SWR bridge and on and on.

For new standards of SSB and CW communication, write for full details or talk it over with your TEN-TEC dealer. We'd like to tell you why "They Don't Make 'Em Like They Used To" makes Ham Radio even more fun.

TRITON IV $699.00

ACCESSORIES:
Model 240 One-Sixty Converter....$ 97.00
Model 244 Digital Readout 197.00
Model 245 CW Filter ..... $ 25.00
Model 249 Noise Blanker 29.00
Model 252G Power Supply 99.00
Model 262G Power Supply/VOX.. 129.00

TEN-TEC

KR20-A ELECTRONIC KEYER
A fine instrument for all-around high performance electronic keying. Paddle actuation force is factory adjusted for rythmic smooth keying. Contact adjustments on front. Weighting factor factory set for optimum smoothness and articulation. Over-ride "straight key" conveniently located for emphasis, QRS sending or tune-up. Reed relay output. Side-tone generator with adjustable level. Self-completing characters. Plug-in circuit board. For 117 VAC, 50-60 Hz or 6-14 VDC. Finished in cream and walnut vinyl. **PRICE $67.50**

KR5-A ELECTRONIC KEYER
Similar to KR20-A but without side-tone oscillator or AC power supply. Ideal for portable, mobile or fixed station. A great value that will give years of troublefree service. Housed in an attractive case with cream front, walnut vinyl top. For 6-14 VDC operation. **PRICE $38.50**

KR1-A DELUXE DUAL PADDLE
Paddle assembly is that used in the KR50, housed in an attractive formed aluminum case. **PRICE $25.00**

KR2-A SINGLE LEVER PADDLE
For keying conventional "TO" or discrete character keyers, as used in the KR20-A. **PRICE $15.00**

KR50 ELECTRONIC KEYER
A completely automatic electronic keyer fully adjustable to your operating style and preference, speed, touch and weighting, the ratio of the length of dits and dahs to the space between them. Self-controlled keyer to transmit your thoughts clearly, articulately and almost effortlessly. The iambic (squeeze) feature allows the insertion of dits and dahs with perfect timing.

An automatic weighting system provides increased character to space ratio at slower speeds, decreasing as the speed is increased, keeping the balance between smoothness at low speeds and easy to copy higher speed. High intelligibility and rythmic transmission is maintained at all speeds, automatically.

Memories provided for both dits and dahs but either may be defeated by switches on the rear panel. Thus, the KR50 may be operated as a full iambic (squeeze) keyer, with a single memory or as a conventional type keyer. All characters are self-completing.

PRICE $110.00

SPECIFICATIONS
Speed Range: 6-50 w.p.m.
Weighting Ratio Range: 50% to 150% of classical dit length.
Memories: Dit and dah. Individual defeat switches.
Paddle Actuation Force: 5-50 gms
Power Source: 117VAC, 50-60 Hz, 6-14 VDC
Finish: Cream front, walnut vinyl top and side panel trim.
Output: Reed relay. Contact rating 15 VA, 400 V. max.
Paddles: Torque drive with ball bearing pivot.
Side-tone: 500 Hz tone.
Adjustable output to 1 volt.
Size HWD: 2½" x 5½" x 8¼"
Weight: 1¾ lbs.

TEN-TEC

KR50A

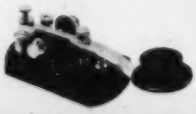
Model 310-001: Standard Key, nickel plated hardware, no switch — $6.65.

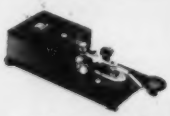
Model 310-003: Standard Key, nickel plated hardware, with switch — $8.25.

Model 320-001: Standard Heavy Duty Key with nickel plated hardware, no switch — $8.20.

Model 320-003: Same as -001 except with switch — $9.35.

322-001





Code Practice Set with Key — $18.50.

SSK-1: Chrome plated — $29.95; Black Wrinkle Finish — $23.95.

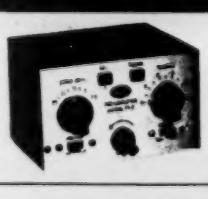
Now You Can Receive The Weak Signals With The ALL NEW AMECO PREAMPLIFIER

Model PT-2 is a continuous tuning 6-160 meter Pre-Amp specifically designed for use with a transceiver. The PT-2 combines the features of the well-known PT with new sophisticated control circuitry that permits it to be added to virtually any transceiver with No modification. No serious ham can be without one.

- Improves sensitivity and signal-to-noise ratio.
- Boosts signals up to 26 db.
- For AM or SSB.
- Bypasses itself automatically when the transceiver is transmitting.
- FET amplifier gives superior cross modulation protection.
- Advanced solid-state circuitry.
- Simple to install.
- Improves immunity to transceiver front-end overload by use of its built-in attenuator.
- Provides master power control for station equipment.

MODEL PT-2

$69.95



HAM RADIO / MOBILE COMMUNICATIONS

THOMSON-CSF
NPC
ELECTRONICS

MODEL	NET PRICE		
12V4	$19.95	*13 HM 4	$41.95
600	$20.50	104R	$49.95
102	$24.95	12/115	$69.95
612	$27.95	108R	$79.95
107	$28.95	108RM	$99.95
12 HM 4	$29.95	109R	$149.95

MODEL 12HM4

NPC 2.5 Amp Regulated Power Supply. Solid State. Short Circuit Protected.

Low cost regulated power supply quietly converts 115 volts AC to 13.5 volts DC ±200 millivolts. 1.5 amps continuous, 2.5 amps reg. Ideally suited for operating mobile CB transceivers in your home or office base station.

ALSO! Available as 13 HM 4 with built-in loudspeaker.

	TYPICAL	MAXIMUM
Output Voltage	13.5 ±.5VDC	14VDC
Continuous Current	1.5 Amp	
Regulation	2.5 Amp	
Ripple/Noise	5 mV RMS	10 mV RMS

Case: 3" (H) x 4" (W) x 5¼" (D). Shipping Weight: 3 lbs.

MODEL 107

NPC 4 Amp Power Supply, 6 Amp Max. Solid State. Overload Protected

Functions silently in converting 115 volts AC to 12 volts DC. 4 amps continuous, 6 amps max. Enables anyone to enjoy CB radio, car 8-track cartridge, cassette player or car radio in a home or office.

Continuous Current (Full Load)	4 Amp
Output Voltage (No Load)	16 V max
Output Voltage (Full Load)	12 V min
Filtering Capacitor	10,000 uF
Ripple (Full Load)	.5 V RMS
Short Circuit Protection	Thermal Breaker

Case: 3" (H) x 4⅝" (W) x 5¾" (D). Shipping Weight: 5 lbs.

MODEL 103R

NPC 4 Amp Regulated Power Supply. Solid State. Dual Overload Protection.

Converts 115 volts AC to 13.6 volts DC ±200 millivolts. Handles 2.5 amps continuous and 4 amps max. Ideally suited for applications where no hum and DC stability are important such as CB transmission, small Ham radio transmitter, and high quality eight-track car stereos. Can also be used to trickle-charge 12 volt car batteries.

	TYPICAL	MAXIMUM
Output Voltage	13.6 ±.2 VDC	13.6 ±.3 VDC
Line/Load Regulation	20 mV	50 mV
Ripple/Noise	2 mV RMS	5 mV RMS
Transient Response	20 uSec	
Current Continuous	2.5 Amp	
Current Limit	4 Amp	
Current Foldback	1 Amp	

Case: 3" (H) x 4¾" (W) x 5¼" (D). Shipping Weight: 4 lbs.

MODEL 109R

NPC 25 Amp Regulated Power Supply. 4-Way Protected. Output Voltage and Current Meters.

Extra heavy-duty unit quietly converts 115 volts AC to 13.6 volts DC ±200 millivolts. 10 amps continuous, 25 amps max. All solid state. Features dual current overload, overvoltage and thermal protection. Ideally suited for operating mobile Ham radio and linear amplifier in your home or office. Excellent bench power supply for testing and servicing of mobile communications equipment.

	TYPICAL	MAXIMUM
Output Voltage	13.6 ±.2VDC	13.6 ±.3VDC
Line/Load Regulation	50 mV	100 mV
Ripple Noise	5 mV RMS	10 mV RMS
Transient Response	20 uSec	
Current Continuous	10 Amp	
Current Limit	26 Amp	
Overvoltage Protection	14.5 V	15 V
Thermal Overload	180°F	

Case: 4⅝" (H) x 9" (W) x 8½" (D). Shipping Weight: 15 lbs.

MODEL 12V4

NPC 1.75 Amp Power Supply. 3 Amp Max.

Functions silently in converting 115 volts AC to 12 volts DC. Ideally suited for most applications including 8-track stereo, burglar alarm, car radio and cassette tape player within power rating.

Continuous Current (Full Load)	1.75 Amp
Output Voltage (No Load)	16 V max
Output Voltage (Full Load)	12 V min
Filtering Capacitor	5,000 uF
Ripple (Full Load)	.4 V RMS
Short Circuit Protection	Thermal Breaker

Case: 3" (H) x 4" (W) x 5¼" (D). Shipping Weight: 3 lbs.

MODEL 108RM

NPC 12 Amp Regulated Power Supply. Solid State. 3-Way Protected. Current Meter.

This heavy duty unit quietly converts 115 volts AC to 13.6 volts DC ±200 millivolts. 8 amps continuous, 12 amps max. All solid state. Features dual current overload and overvoltage protection. Ideally suited for operating mobile Ham radio 2 meter AM-FM-SSB transceivers in your home or office. Can also be used to trickle-charge 12 volt car batteries.

	TYPICAL	MAXIMUM
Output Voltage	13.6 ±.2VDC	13.6 ±.3VDC
Line/Load Regulation	20 mV	50 mV
Ripple/Noise	2 mV RMS	5 mV RMS
Transient Response	20 uSec	
Current Continuous	8 Amp	
Current Limit	12 Amp	
Current Foldback	2.5 Amp	
Overvoltage Protection	14.5 V	15 V

Case: 4¼" (H) x 7½" (W) x 5½" (D). Shipping Weight: 9.5 lbs.

ALSO AVAILABLE AS MODEL 108RA WITHOUT METER AND OVERVOLTAGE PROTECTION.

MODEL 104R

NPC 6 Amp Power Supply Regulated. Solid State. Dual Overload Protection.

Converts 115 volts AC to 13.6 volts DC ±200 millivolts. Handles 4 amps continuous and 6 amps max. Ideally suited for applications where excellent DC stability is important, such as CB transmission, small Ham radio transmitter, and high quality eight-track car stereos. Can be used to trickle-charge 12 volt car batteries.

	MAXIMUM	TYPICAL
Output Voltage	13.6 ±.2 VDC	13.6 ±.3 VDC
Line/Load Regulation	20 mV	50 mV
Ripple/Noise	2 mV RMS	5 mV RMS
Transient Response	20 uSec	
Current Continuous	4 Amp	
Current Limit	6 Amp	
Current Foldback	2 Amp	

Case: 3½" (H) x 5½" (W) x 6½" (D). Shipping Weight: 6 lbs.

MODEL 102

NPC 2.5 Amp Power Supply. 4 Amp Max. Solid State. Overload Protected.

Functions silently in converting 115 volts AC to 12-volts DC. 2.5 amps continuous, 4 amps max. Enables anyone to enjoy CB radio, car 8-track cartridge, cassette tape player or car radio in a home or office.

Continuous Current (Full Load)	2.5 Amp
Output Voltage (No Load)	16 V max
Output Voltage (Full Load)	12 V min
Filtering Capacitor	5,000 uF
Ripple (Full Load)	.6 V RMS
Short Circuit Protection	6 Amp
	Thermal Breaker

Case: 3" (H) x 4¾" (W) x 5¼" (D). Shipping Weight: 4 lbs.

	12 VDC IN	14 VDC IN
Output Voltage (No Load)	115 V RMS	130 V RMS
Output Voltage (Full Load)	100 V RMS	115 V RMS
Frequency (No Load)	58 Hz	66 Hz
Frequency (Full Load)	54 Hz	62 Hz
Power Continuous	200W	
Power Peak	240W	
Parallel Connection	350W	

All Values Are Typical

MARINE & RV

MODEL 12-115

NPC 12-115 Solid State Inverter. 200 W. Parallel Connection for Higher Power up to 350 W.

Converts 12 volts DC to 115 volts AC @ 60 Hz output. 200 watts continuous operation with peak power up to 240 watts. All silicon semiconductors assure high reliability at excessive ambient temperatures. The output voltage is a square wave. The inverter is not recommended where high transients are not tolerable.

The 12-115 allows you to have AC house current in your boat, car, truck, camper, house trailer, or houseboat. Will operate small household appliances, T.V., hand tools, electric shaver, AC radios, and lights within power rating. Built-in overload protection.

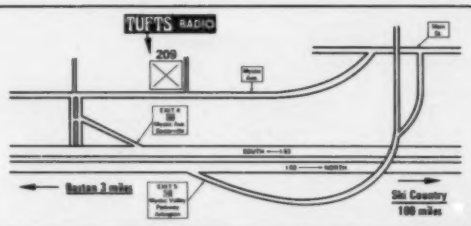
Case: 4½" (H) x 7½" (W) x 5½" (D). Shipping Weight: 7 lbs.

MODEL 612

Model 612 Power Converter

NPC 612 converts 6 volt negative ground or 12 volt positive ground electrical systems to 12 volt negative ground operation. Provides full 3 amp continuous power. The inexpensive solution for installing car radios, stereo and cassette tape players, in vehicles with 6 volt negative ground or 12 volt positive ground systems.

Case: 2¾" (H) x 3" (W) x 5" (D). Shipping Weight: 1 lb.



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TUFTS RADIO CATALOG TUFTS RADIO

model 372 CLIPREAMP

Get maximum legal modulation without danger of splatter. Solid-state speech preamplifier and clipper for transmitters, public-address systems, and tape recorders needs no external power.

Model 372 — $27.50

▪ specifications

Input Impedance	100,000 ohms
Input Levels	5 millivolts to 20 millivolts
Voltage Gain	30 dB
Output Level	60 millivolts
Output Impedance	50,000 ohms
Power	9-volt transistor battery, Burgess 2U6 or equivalent
Size	3-3/4" x 3" x 4-1/2"
Shipping Weight	7 oz.
Connectors	Terminal strip

COAXIAL ANTENNA CHANGEOVER RELAY

model 377

Economical and reliable. Can be operated from VOX circuit for completely automatic operation or from PTT or manual T/R switch. Receiver input is automatically grounded when the relay is in the Transmit position. Wide AC operating voltage range and low operating current.

Model 377 — $17.95

▪ specifications

Power Rating	1000 watts CW (2000 watts SSB)
VSWR	Less than 1.15:1, DC to 150 MHz
Power Requirements	0.015 Ampere, 48 to 130 volts AC
Connectors	UHF Type SO-239
Dimensions	3-1/2" x 1-1/2"
Shipping Weight	1 lb.

UNIVERSAL HYBRID COUPLER II PHONE PATCH

model 300W and model 300TW

Connect your station to the telephone lines. Five switch-selectable modes give complete flexibility for patching the station to the line and for tape recording and playback to or from the line or the station. The hybrid circuit provides for effortless VOX operation of the phone patch. A built-in *Compreamp* speech preamplifier/limiter (in Model 300ZW) increases the level of weak phone signals, and also prevents overmodulation when the local telephone is used as the station microphone. (The *Compreamp* also functions as a preamplifier/limiter with the station microphone, if desired.)

Model 300 2W with *Compreamp* — $125.00

Model 300 1W without *Compreamp* — $85.00

▪ specifications

Inputs from:	
Line	600 ohms
Receiver	4 ohms
Microphone	High impedance (50,000 ohms) crystal or dynamic
Tape Recorder	4 ohms
Outputs to:	
Transmitter	50,000 ohms
Receiver Speaker	4 ohms
Tape Recorder	0.5 megohm
Size	9-1/2" x 7-1/2" x 3"
Shipping Weight	3-1/2 lbs.
Power	9-volt battery, Burgess 2U6 or equivalent
Connectors	Phono

BARKER & WILLIAMSON, INC.

Model 359 — $37.50

Increase your transmitter's effective speech power up to four times. Or use it with your tape recorder or public address system for improved performance. This two-stage, transistorized Audio Preamplifier/Limiter can be used with all types of transmitters. Powered by a long-lasting dry-cell battery—no external power needed. Installs without any wiring changes in your transmitter. Just connect the *Compreamp* between your microphone (50,000-ohm dynamic or high-impedance ceramic) and your transmitter's microphone input connector. Front-panel rocker switch lets you bypass the *Compreamp* when you want to. Compression level is adjustable, too.

▪ specifications

Input Impedance	100,000 ohms
Input Level	5 millivolts to 20 millivolts
Voltage Gain	30 dB
Output Level	60 millivolts
Output Impedance	50,000 ohms
Power	9-volt transistor battery, Burgess 2U6 or equivalent
Size	3-3/4" x 3" x 4-1/2"
Shipping Weight	9-1/2 oz.
Connectors	Terminal strip

COAXIAL SWITCHES AND ACCESSORIES

for antenna selection and RF switching

These high-quality switches have set the standard for the industry for years. Ceramic switches with silver-alloy contacts and silver-plated conductors give unmatched performance and reliability from audio frequencies to 150 MHz.

B&W coaxial switches are designed for use with 52- to 75-ohm non-reactive loads, and are power rated at 1000 watts AM, 2000 watts SSB. Connectors are UHF type. Insertion loss is negligible, and VSWR is less than 1.2:1 up to 150 MHz.

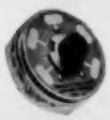
Crosstalk (measured at 30 MHz) is -45 dB between adjacent outlets and -60 dB between alternate outlets.

Models are available for desk, wall, or panel mounting, and with or without protective grounding of inactive outputs. Radial (side-mounted) connector models can be either wall or panel mounted; axial (backplate-mounted) connector models are for panel mounting only, save panel space.

Use the selector chart below to choose the models you need.

Model 550A

Model 590


Model 590G

Model 551A

Model 592

Model 595

COAXIAL SWITCH SELECTOR CHART

Model	PRICE	Outputs	Connector Placement	Mounting: Panel	Mounting: Wall	Mounting: Desk	Automatic Grounding	Dial Plate	Remarks
375	18.95	6	Axial	x			x	Supplied	PROTAX switch. Grounds all except selected output circuit.
376	18.95	5	Radial	x	x		x	Supplied	PROTAX switch. Grounds all except selected output circuit. Sixth switch position grounds all outputs.
550A	14.00	5	Radial	x	x			DP-5	
550A-2	12.50	2	Radial	x	x			DP-2	
551A	17.50	2	Radial	x	x			DP-2	Special 2-pole, 2-position switch used to switch any RF device in or out of series connection in a coaxial line. See figure (over).
556	.95	–	–		x			–	Bracket only, for wall mounting of radial connector switches.
590	17.95	5	Axial	x				DP-5	
590G	17.95	5	Axial	x			x	Supplied	Grounds all except selected output circuit.
592	16.50	2	Axial	x				DP-2	
595	18.50	6	In-line		x	x	x		Grounds all except selected output circuit.

Model 376

Model 375

Model 550A-2

William J. Hosking W7JSW
8626 E. Clarendon
Scottsdale AZ 85251

Drive More Safely with a Mobile Dialer

- - hold 4 or 8 phone numbers in a PROM

Shortly after arriving in the Phoenix area, I acquired the means (a Ma Bell pad) to use our autopatch. Shortly thereafter, having narrowly missed a little old lady while I was attempting to make a call on the patch and drive at the same time, I decided that an automatic dialer for commonly used numbers would be handy.

I had surplus 512 bit TTL PROMs on hand which seemed perfectly suited for the job. I started the design job about a year ago and, within a couple of weeks, had everything up to the actual tone generator working satisfactorily. At that time there were only about two options available for tone generation: one was a hybrid chip selling for close to $30 and another was the 566 PLL function generators. For size and economy reasons I chose the 566 route. After several weeks of less than spectacular success attempting to switch the 566s with TTL logic and maintain tone frequencies, I shelved the project and subsequently forgot about it. Motorola introduced a touch-tone generator in their CMOS line, the MC14410, which shows great promise. The tone switching can be CMOS, TTL, or just plain switches, and the output is approximately a sine wave. As soon as I got my hands on one of the chips, I pulled my automatic dialer off the shelf, ripped the 566s out, and wired in the 14410. It worked perfectly the first time.

Memory Arrangement

Since I had the 512 bit memories available, I had plenty of room to use a simple code. The basic memory is organized as 64 bytes, each eight bits long. I stored each digit of a telephone number in a byte location as

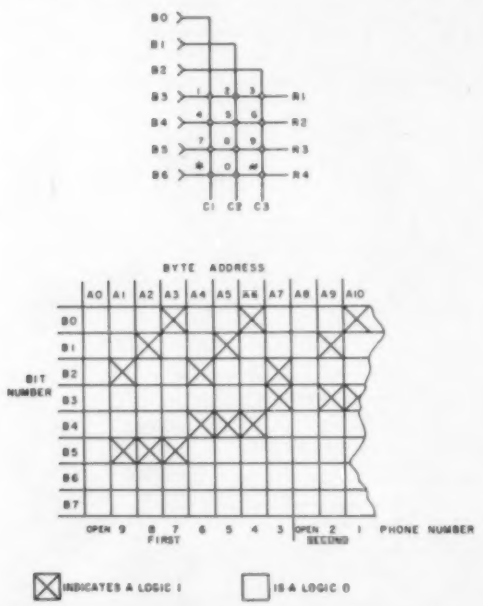


Fig. 1. Programming and coding for the four number dialer. Also shown is a sample program for the phone number 987-6543.

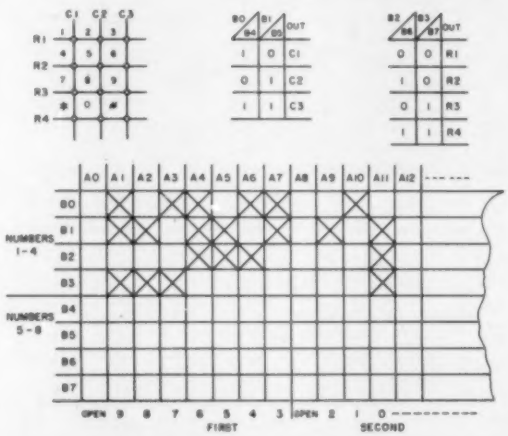


Fig. 2. Programming and coding for the eight number dialer. Also shown is a sample program for the phone number 987-6543.

a combination of a row and a column bit. An example of the coding is shown in Fig. 1. Each phone number requires seven digits (seven bytes) and, since the memory breaks down conveniently into address groups of eight bytes, that is the way I programmed it. This approach allowed eight phone numbers to be stored in a 512 bit memory and be selected with a BCD code.

A perusal of the surplus ads shows that 512 bit PROMs are not readily available but 256 bit ones are — and they are reasonably priced (around $5). The drawback, of course, is that a memory of half the size can only store half as many numbers (four). In order to store more telephone numbers in a smaller memory, a more complex coding system is necessary.

A scheme I developed later to achieve the higher density coding is shown in Fig. 2. Using this coding, a phone number would be stored in the first four bits of seven bytes and another phone number in the last four bits of the same seven bytes. A data selector chip selects which four bits out of each byte are to be used. With this scheme the first four telephone numbers are stored in bits B0-B3 of words 0 through 31 and the second four stored in bits B4-B7 of the same bytes.

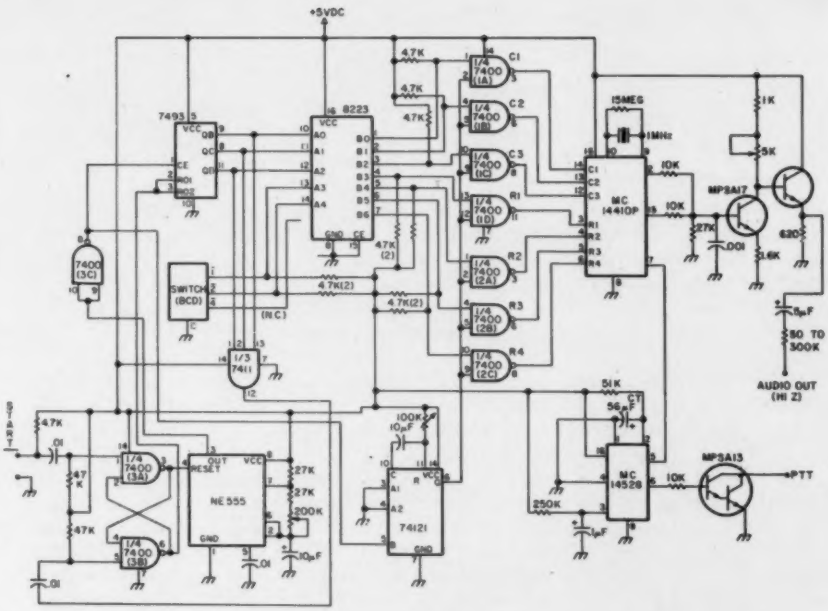


Fig. 3. Schematic diagram of the four number automatic dialer.

Circuits

Circuits for the four number and eight number units are shown in Figs. 3 and 4 respectively. Everything up to the output of the memory is the same for both units.

A 7400 gate is cross-connected as a start/stop flip-flop. When the start button is pushed, it sets the F-F, which starts the 555 clock generator. The clock generator feeds a 7493 counter and a 74121 monostable through an inverter. The counter counts the clock pulses and puts out a binary address to the memory. For each clock pulse, the monostable puts out a pulse which gates the selected tones on for a short period. The inverter after the clock causes the gating to start with address position A1 instead of A0. This allows time for your transmitter and the repeater receiver to be fully on before the first tone comes along. The outputs of the counter are decoded with a 7411 gate whose output stops the start/stop F-F when a count of seven is reached. The two remaining memory address inputs are selected by a BCD coded switch.

For the four number model the memory outputs go through NAND gates to the tone generator. The monostable strobes the NAND gates, letting the selected row and column information through.

For the eight number model, the memory outputs feed a 74157 data selector which selects outputs B0-B3 or B4-B7, depending on the select input from the BCD switch. In this version the data strobing is done with the 74157 instead of with the NAND gates. The NAND gates and an added 7404 hex inverter are now used to

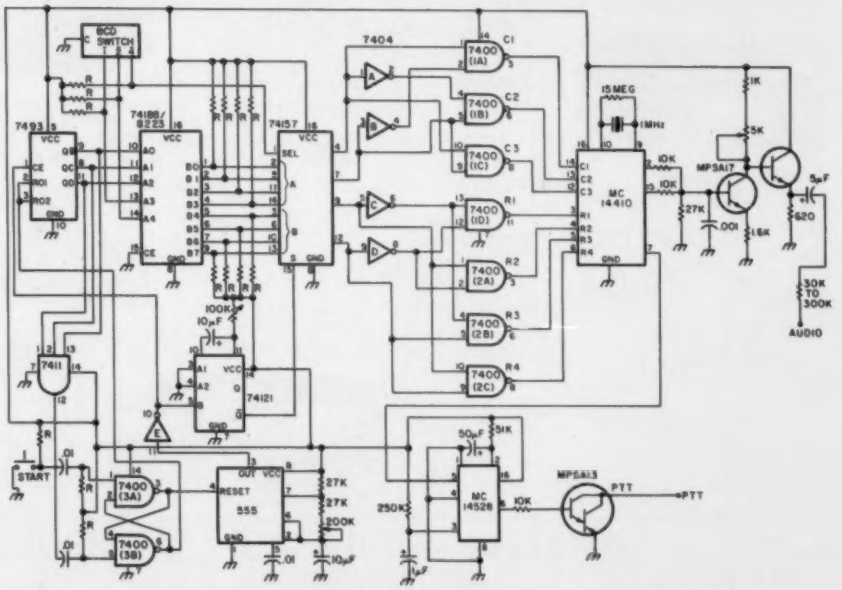
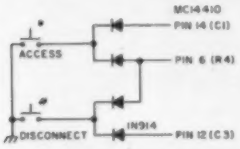


Fig. 4. Schematic diagram of the eight number automatic dialer.

Fig. 5. Schematic of the added switches for access/disconnect.



decode the 74157 outputs to give proper row and column inputs to the tone generator.

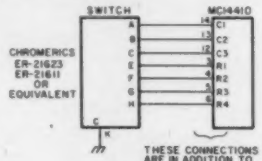
In both cases the NAND gate outputs put a logic low on the appropriate row and column inputs of the MC14410 to produce the desired tones. The output of the tone generator is filtered and buffered, and a level control provided. My schematics show a high value of series resistor, since most of my radios have a high impedance input.

Pin 7 of the 14410 is a pulsed logic output which is used to trigger a 14528 monostable which, through a Darlington transistor, operates the transmitter PTT line. The delay on the PTT line with the parts shown is about one second. Capacitor C_T can be varied to change the hold time.

In both Figs. 3 and 4 the BCD switch is shown wired for complemented outputs. This means that a switch is open when selected rather than closed when selected. If a complement output is not available, the 4.7k resistors must be changed to 470Ω and connected to ground instead of +5. Also, the common then connects to +5 instead of ground.

All of the above takes care of the actual phone number once the patch is accessed, but in our case it takes a "*" to access and a "#" to disconnect the autopatch. To do this I added two pushbuttons and 4 diodes to directly turn on the proper row and column tones. The connections I made for this purpose are shown in Fig. 5. Not shown is an LM309K 5 volt regulator I use to provide the five volts from the 12 volt line.

Fig. 6. Connections for adding a touch switch such as the Chromerics ER-21623 or ER-21611 to the dialer.



Operation

Operation is simple. I used a BCD coded thumbwheel switch for the number selection. I select the number, push the access button and, when I get the dial tone, push the start button.

Conclusion

The circuit works perfectly as is and the current drain isn't excessive. It seems a shame to use CMOS devices (14410, 14528) with the power hungry TTL devices, but one must use what is in the junk box. I expect I'll build one using CMOS soon, although a memory might be a problem. A friend suggested a RAM instead of the PROM, since the field PROMs, once programmed, contain the same information forever. Although the RAM would allow reprogramming, it would also require a continuous power supply, however small, to maintain memory. Anyway, it's something to consider.

To make the unit more versatile, a switch such as the Chromerics ER-21623 or ER-21611 could be wired in the way I did with the access/disconnect pushbuttons, to allow the unit to function as a normal touch-tone pad. The connection is shown in Fig. 6. If this is done, the switches of Fig. 5 are not needed.

I didn't include programming information on the PROM, as it is fairly readily available. However, I'll be glad to help anyone having trouble finding information (SASE please, though). ■

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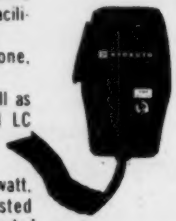

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CONTESTS

ARRL DX COMPETITION
Phone
Starts: 0001 GMT Saturday, February 5
Ends: 2359 GMT Sunday, February 6
Starts: 0001 GMT Saturday, March 5
Ends: 2359 GMT Sunday, March 6
CW
Starts: 0001 GMT Saturday, February 19
Ends: 2359 GMT Sunday, February 20
Starts: 0001 GMT Saturday, March 19
Ends: 2359 GMT Sunday, March 20

These rules were taken from last year's contest. Please check the December issue of *QST* for complete rules and any last minute changes.

Briefly, the rules are as follows: All fixed station amateurs, worldwide, are invited to participate. All amateurs in the 48 states and Canada will try to work as many stations in other parts of the world as possible. All other stations will work only W/VE stations. Entries may be in either the CW or phone section; each is scored independently. Entries are further classified as single or multiple operator stations. Single transmitter multi-operator stations will be recognized as a distinct category from multi-transmitter, multi-operator stations. Two transmitters on the band at the same time are prohibited. Single operator stations may enter in either the all band, high band, or low band categories. High band is 20, 15 and 10 meters, while low band is 160, 80 and 40 meters. Operating on a band not allowed in your class is permitted but those points will not be counted toward your total score. Crossband and crossmode contacts are not allowed.

EXCHANGE:

W/VE stations will send RS(T) and state or province. All others send RS(T) and power. KH6 and KL7 are considered DX.

SCORING:

Score 3 points for each completed QSO. Each station may be worked once on each band on each mode for contact and multiplier credit. Final score is the total number of QSO points times the total number of countries on each band (for W/VE stations), or the total number of continental states plus VE/VO licensing areas worked on each band (for DX).

AWARDS:

A plaque will be awarded to the highest single operator DX phone and CW station (non-W/VE) in each continent. On both phone and CW, a certificate will be awarded to the highest scoring station in each category and classification in KL7, KH6, each ARRL section, and each country where a valid entry is received. Also, a certificate will be awarded to each non-country winner DX entrant making 1000 or more QSOs on either mode. ARRL-affiliated clubs may also participate in club competition as described in *QST*.

LOGS:

A summary sheet, log sheets, and DX check-off sheet for each band used is required from all W/VE entries. DX entries must submit log sheets and a summary sheet. Separate logs, summaries, and check sheets are required for each mode used from all entries (no check sheets for DX). Logs and forms are available from ARRL, 225 Main St., Newington CT 06111.

ARRL NOVICE ROUNDUP
Starts: 0001 GMT Saturday, February 5
Ends: 2359 GMT Sunday, February 13

The contest is open to all amateurs in any ARRL section. Operating time must not exceed 30 hours total during the 9 day period while off periods may not be less than 15 minutes at a time. Times on and off must be entered in your log. Crossband contacts are not allowed. Novices may work anyone while non-Novices must work Novices only. Each station may be worked only once regardless of band.

EXCHANGE:

RST and ARRL section.

SCORING:

Each completed QSO counts one point. The total multiplier is the number of ARRL sections and foreign countries worked. VE8 counts as a separate section. The final score is the number of QSO points plus your ARRL code proficiency credit (15 wpm = 15 pts.) times the total multiplier.

AWARDS:

Certificates will be awarded to the highest scoring Novice in each ARRL section. Multi-operator or higher class licensees are not eligible for awards, but the top ten scores will be listed in the results.

LOGS:

Use official ARRL forms available from: ARRL, 225 Main St., Newington CT 06111. All entries should be sent to this same address.

Please check the January issue of QST for any last minute changes in rules or operating times.

QCWA QSO PARTY
Starts: 2300 GMT Friday, February 11
Ends: 2300 GMT Sunday, February 13

Every contact with another QCWA member will count; contest is only open to members. Briefly the rules are as follows.

EXCHANGE:

QSO number, QTH (state, province, or country), name, and QCWA membership number.

SCORING:

Each contact with another QCWA member counts 1 point. Any foreign QCWA member except Canada, Mexico, and US possessions count 5 points per QCWA QSO outside their own country. Count a multiplier of 1 for each state, province, US possession, country, or political sub-division designated by a callsign prefix. Final score is QSO points times multiplier as usual. A contact with the QCWA memorial station W2MM/6 counts for 2 points. Each station may be worked only once regardless of band or mode.

FREQUENCIES:

Phone — 1805-1825, 3940-3960, 7240-7260, 14240-14260, 14280-14300, 21340-21360, 28640-28660.
CW — 1805-1825, 3540-3560, 7040-7060, 14040-14060, 21040-21060, 28040-28060.

Contacts made on net frequencies are not valid!

LOGS:

Identify each sheet with name, call, QCWA number, address, city, state, and zip. Number pages and staple them together. Logs should show all exchange info plus band, mode, time, date, and duplicate check columns at right. Compute score and include with logs. Logs must be mailed not later than February 20th to: Ralph Cabanillas, Jr. W6IL, 2359 Creston Dr., Hollywood CA 90068.

TEN-TEN NET
WINTER QSO PARTY
Starts: 0000 GMT Saturday, February 12
Ends: 2400 GMT Sunday, February 13

The contest is sponsored by the Ten-Ten International Net of Southern California, Inc., and is open to all amateurs — but only 10-10 members are eligible for awards. All contacts must be made on 10 meters, any mode, and a station may be counted only once.

EXCHANGE:

Name, QTH, and 10-10 number.

SCORING:

1 point for each contact plus 1 point if with a 10-10 member. Maximum of 2 points for any one contact.

LOGS:

Logs should include date and time of each contact as well as the required exchange information.

AWARDS (for 10-10 members only):

Certificates to first and second place winners in each US district, Alaska, Hawaii; each VE district; Central America and Caribbean; South America; Europe; Africa and South Atlantic; Asia and Northern Pacific; Australia, New Zealand and South Pacific. Send logs to Grace Dunlap K5MRU, Box 445, La Feria TX 78559, by March 31. For complete results, see the *10-10 Net Summer Bulletin*. To become a 10-10 member, work any 10 members and send a list of those contacted along with $3.00 to the manager in your district.

CALENDAR

Jan 22 - 23	CD Party — Phone
Feb 5 - 6	ARRL DX Contest — Phone
Feb 5 - 13	ARRL Novice Roundup
Feb 11 - 13	QCWA QSO Party
Feb 12 - 13	10-10 Net Winter QSO Party
Feb 19 - 20	ARRL DX Contest — CW
Feb 19 - 20	YLRL YL-OM Contest — Phone
Mar 5 - 6	ARRL DX Contest — Phone
Mar 5 - 6	YLRL YL-OM Contest — CW
Mar 13	South Dakota State QSO Party
Mar 19 - 20	ARRL DX Contest — CW
Mar 26 - 27	CQ Worldwide WPX SSB Contest
Mar 26 - 28	BARTG Spring RTTY Contest
Apr 12 - 13	YLRL DX-YL to Stateside YL Contest — CW
Apr 16 - 17	CD Party — CW
Apr 23 - 24	CD Party — Phone
Apr 26 - 27	YLRL DX-YL to Stateside YL Contest — Phone
June 11 - 12	ARRL VHF QSO Party
June 18 - 19	WVA QSO Party
June 25 - 26	ARRL Field Day
July 2 - 3	QRP Summer Contest
July 4	ARRL Straight Key Night
July 9 - 10	Bicentennial Celebration Plus One (ARRL)

Included are a few late-comers from overseas and the official dates for ARRL contests.

YL-OM CONTEST

Phone
Starts: 1800 GMT Saturday, February 19
Ends: 1800 GMT Sunday, February 20
CW
Starts: 1800 GMT Saturday, March 5
Ends: 1800 GMT Sunday, March 6

Sponsored by the YLRL, the contest is open to all licensed operators throughout the world. All bands may be used but crossband operation and net contacts are not permitted. Phone and CW contacts will be scored as separate contests, so please submit separate logs. A station may be contacted no more than once in each contest for credit.

EXCHANGE:

QSO number, RS(T), and ARRL section or country.

SCORING:

One point is earned for each station worked, YL to OM or OM to YL. Multiply the number of different ARRL sections and/or countries worked. Contestants running 150 Watts input or less on CW and 300 Watts PEP or less on phone may multiply the score by 1.25 (low power mult).

LOGS:

Entries in your logs must show band worked at time of contact, time and date, and transmitting power. Please remember to submit separate logs for phone and CW. Send logs to: YLRL Vice President, Beth Newlin WA7FFG, 826 W. Prince Road – 06, Tucson AZ 85705.

A cup will be awarded to the first place YL and OM on both phone and CW. Second and third place winners in each contest will receive certificates. Certificates will also be awarded to the high score phone and CW winners of each state, VE call area, and each country.

CW COUNTY HUNTERS NET AWARDS PROGRAM (net meets Mon 2400Z/3575, Wed 2300Z/7055, Sat 1400Z & 2000Z/14070 and Sun 1430Z/7055)

Basic awards are $1.00 with endorsements for band, mode or mixed. Seals and endorsements free at time of issue; thereafter SASE, list and award number required. No date limits, all confirmed contacts count – mobile, portable or fixed. Honor system – no signers needed but awards manager reserves right to request any one or all QSLs at applicant's expense. Send list of required info to: Awards Manager, George Levensalor W1DPJ, 399 Buck St., Bangor ME 04401.

THE UNITED STATES OF AMERICA COUNTIES AWARD BY CALL AREAS

12 separate awards for confirmed contacts with stations operating in counties of the 12 US call areas, 1 through 0, Alaska and Hawaii. Classes: A = all counties in call area; B = 2/3 counties; C = 1/3 counties. Anyone holding all 12 awards Class A (all counties in US) issued free trophy!

RESULTS

RESULTS OF THE 1976 WASHINGTON STATE QSO PARTY

Washington County Winners:

County	Call	Score (pts)
Adams	W7GHT/m	486
Asotin	W7GHT/m	204
Chelan	W7KWT	4012
Clark	W7FQE	4329
Columbia	W7GHT/m	360
Cowlitz	WA7PMW	12006
Douglas	WA7WET	2375
Ferry	WA7WET/m	231
Franklin	W7GHT/m	352
Garfield	W7GHT/m	247
Grant	W7GB	9336
Grays Harbor	W7FGD/m	25
King	WA7UQG	47503
Lewis	W7FGD/m	30
Lincoln	W7GHT/m	459
Mason	W7FGD/m	72
Okanogan	WA7WET/m	251
Pacific	W7FGD/m	32
Pend Orielle	W7GHT/m	90
Pierce	W5QQQ/m	6
San Juan	K7NCG/7	1250
Skagit	W7IEU/7 + WA7FKM	4080
Skamania	W7FGD/m	108
Snohomish	K7UWT	9156
Spokane	K7TAK/7	1755
Stevens	K7KFY/7	7320
Thurston	W7FGD/m	15
Wahkiakum	W7FGD/m	171
Whatcom	W7VRO	51597
Whitman	W7GHT/m	1

Out of state winners:

State/Prov.	Call	Score (pts)
AL	K4ZGB	2160
AK	WB8GLO/KL7	720
AZ	AA7HRE	5916
CA	KØGJD/6	13530
CO	ADØQIX	2772
CT	W1JTD	1672
DE	WA3WPY/3	100
FL	WB4OGW	3600
GA	AAØDGL/4	1050
IL	W9WR	1088
IN	WB9OUX	650
IA	WØPRY	3312
KS	WBØIAQ	1036
KY	W4KFB	144
LA	W5WG	2040
MA	AC1AQE	1292
MI	WB8PFB	550
MN	WBØLNO	936
MS	AB4WHE/5	784
MO	WBØOTA	594
NE	WBØHEU	306
NJ	WA2EJZ	140
NM	W5TIL	815
NY	W2NCI	850
NC	W4OMW	676
OH	AD8MLO	462
OK	K5DEC	650
OR	WA7WHW	14104
PA	AC3ARK	1260
RI	K1QFD	72
SC	K4OAQ	40
SD	WAØBZD	100
TN	AB4WFT	1536
TX	WA5KQD	1240
UT	K7SQD	70
VA	W4JUJ	306
WI	WB9NDO	1800
Manitoba	VE4SW	1248
Ontario	VE3EJK	156
Japan	JR1NRP	270

RESULTS

RESULTS OF THE TEN-TEN INTERNATIONAL NET SUMMER QSO PARTY, AUGUST 7-8, 1976

WA1UAD	394/723	WBØQHV/Ø	716/1277	HP1GD	100/188
WA1KOC	354/662	WBØNHD	468/846	JA3XOG	25/40
K2ARO	464/850	KH6IAA	97/177	ZL1ARO	17/30
WB2WRT	324/605	KH6ILF	83/151	ZL2BAO	12/22
WA3DAL	607/1090	VE1ABR	195/362		
WA3TRI	605/1082	VE2XL	113/209	* Multi-Op. Station	
W4OZF	658/1151	VE2EGH	100/181	*Chapter Scores:*	
W4GKF	573/1017	VE3AHN	210/387	Gateway Chapter	3261/6139
WB5FII	709/1307	VE3FAK	141/270	LIARS	3050/5758
WB5EHF	621/1125	VE4VV	135/250	Delaware Valley	2238/4100
WB6PXP	740/1306	VE4UL	72/139	Colorado	2189/4043
WB6MQA	290/531	VE5SM	19/35	Houston	2132/3992
K7PXI	358/654			Devil's Triangle	2193/3991
WB7AEB	291/551	VE6BCC	48/91	Bay Area	1725/3259
WB8FAG	439/808	VE6BAS	38/72	Michigan Robins	1662/3173
WA6PRL/8	448/803*	VE7SR	134/240	S. N.E. Nutmeg	1483/2781
WB9USW	450/816	YV4BDB	109/204	Thunderbird	1426/2672
WA9ASZ	265/508	LU6DWZ	10/20	MoKan Teners	1243/2364
				Cypress	1266/2344
				Milwaukee	1101/2104
				Sky Blue Waters	1099/2043
				So. California	1074/1993

WHAT HAVE YOU MISSED?

The back issues of 73 are a gold mine of interesting articles . . . just take a look at what's been covered . . . every possible interest. This is the most important library you can have for hamming.

The supply of these back issues is very limited . . . and when these are gone, that will be it. Don't miss out by procrastinating.

Single issues ..... $1.50 each (before 1976)
Ten back issues (your choice) ..... $12 postpaid in US.
Twenty-five back issues (our choice) $20 postpaid in US.
Twenty-five back issues (our choice) $10 postpaid in US.

JUNE 63. Surplus issue: DMO-2 Beacon Tx on 220, increasing ARC-2 transceiver selectivity, PE-97A pwr supply conversion, BC-348 band-spread, inductance tester, converting BC-230 tx, beginner's rx using BC-453, recvr motor-tuning, transistor cw monitor, SC-442 ant relay conversion, mobile loading coils, increasing Two-er selectivity, TV with the ART-28 tx, TRC-8 rx on 220, ARC-5 hf rx & tx, ARC-3 tx on 2M.

AUG 63. Battery op 6M stn, diode noise gen, video modulation, magic T-R switch, ant gain, halo mods, cw breakin, VEE beam design, coax losses, RF wattmeter, TX Tube Guide, diode pwr supply, "Lunchbox" squelch, SWR explanation, vertical ant info, info on Windom ant.

OCT 63. WBFM transceiver ideas, HF propagation, cheap fone patch, remote-tuned Yagi, construction hints, ant coupler, 6S Vertical, filament xformer construction, 2M nuvistor converter, Lafayette HE-35 mods, Buyer's Guide to Rx & Tx, product detector, novel Hi-C VFO, radio astronomy, penadaptor "if" converter, compact mike amp.

FEB 64. 2M multichannel exciter, rx design ideas, mojic t/r switch, loudspeaker enclosures, 40M 2W tx, look at test equipment, radio grounds, 40M ZL Special ant, neutralization.

MAY 67. Quad issue: 432 Quad-quad-quad, expanded HF quad, Two el quad, miniquad, 40M quad, quad experiments, half-quad, three el quad, 20M quad, tiltover quad, easy-to-erect quad, Quad Bibliography, FET vfo, tube troubleshooting, HF dummy load, understanding "dB," HF SSB/cw rx, geometric circuit design, GBB-201 transceive, FET converter for 10-20M, hi-pass rx filters.

JULY 67. VE ham radio, VE6 hams, dsb adaptor, home brew tower, transistor design, "20 World's Fair, gnd plane ant, G4ZU beam, SSTV monitor, UHF FET preamps, IC "if" strip, vertical ant, VHF/UHF dipper, tower hints, scope monitoring, operating desk, S-Line crossband, hi-school ham club, Heath HR-10 mods.

OCT 67. HF solid state rx, rugged rotator, designing slug-tuned coils, FET converter, SSTV pix gen, VHF log-periodics, rotatable dipole, gamma-match cap, old-time dxing, modern dxing.

JUNE 68. Surplus issue: Transformer tricks, BC-1206 rx, APS-13 ATV tx, low voltage dc supply, surplus scope, FM rig commercial xtal types, Wilcox F-3 rx, restoring old equipment, 75A1 rx mods, TRA-19 on 432, freq counter use, tranceiver pwr supply, uses for cheap tape recorders, Surplus Conversion Bibliography, RT-209 walkie on 2M, ARC-1 guard rx, RTTY tx TU.

JULY 68. Wooden tower construction, tiltover towers, erecting a telephone pole, IC AF osc, "dB" explained, ham club tips (Part 1).

SEPT 68. Mobile vhf, 432 FET preamps, converting TV Tuners, xtal osc stability, parallel-Tee design, moonbounce rhombic, 6M xciter (corrections Jen 69), 6M transceiver (corrections Jen 69), 2M dsb amp, ham club tips (Part 3).

NOV 68. SSB xtal filters, solid state trouble-shooting, IC freq counter (many errors & omissions), "cv" transformers, space comm odyssey, pulsed info, thin-wire ants, 40M transistor cw tx/rx, SC-348M double conversion, multifunction tester, copper wire specs, thermistor applications, hi-voltage transistor list, ham club tips (Part 5).

JAN 69. Suppressor compressor, HW-12 on 160, beam tuning, AC voltage control, 2M transistor tx, LC power reducer, spectrum analysis info, 6M transistor rx, operating console, RTTY autostart, calculating osc stability, to-pwr 40 cw tx, sequential relay switching, sightless operator's bridge, ham club tips (Part 7).

FEB 69. SSTV camera mod for fast-scan, tri-band linear, selective af filter, unijunction transistor info, Nikola Tesla biography, mobile installation hints, extra-class license study (Part 1).

MAR 69. Surplus issue: TCS tx mods, cheap compressor/amp, RXZ calculations, transistor keyer, better balanced modulator, transistor oscillators, using receivers, halfwave feedline info, Surplus Conversion Bibliography, extra license study (Part 2).

APR 69. 2-channel scope amp, rx preamp, Two-er PTT, variable DC load, SWR bridge, 100 kHz marker gene, some transistor specs, SB-610 monitorscope mods, portable 6M AM tx, 2M converter, extra license study (Part 3).

MAY 69. 2M Turnstile, 2M Slot, rx attenuator, generator filter, short VEE, quad tuning, using antennascope, measuring ant gain, phone patch regs, SWR indicator, 160M short verticals, 15M antenna, HF propagation angles, PSK exciter, KW summy load, hi-power linear, extra license study (part 4), all-band curtain array.

JUNE 69. Microwave pwr generation, 6M sb tx, 432-er tx/rx, 6M converter, 2M 5/8 wave whip, UHF tv tuners, ATV video modulator, UHF FET preamps, RTTY monitorscope, extra license study (part 5), building uhf cavities, mini-VEE for 10-20M, vhf vfo.

JULY 69. AM modulator, SSTV sig gen, 6M kw linear, 432 KW amp, 432-er tx/rx, 6M IC converter, radio-controlled models, RTTY IC TU, audio notch filter, VRC-19 conversion, tube substitution, 2M transistor exciter, extra license study (part 6), hf FET vfo.

AUG 69. FET regen for 3.5 MHz up, FM crystal switching, 5/8 wave vertical, introduction to ICs, RTTY tone gen, good/bad transistor checker, 2M AM tx, measure transistor Ft, 160M propagation, triac applications, simple IF sweep gen, transistor keyer, SB-100 on 6M, xtal freq measurement, extra license study (part 7), FM deviation meter, qrp am 6M tx, circular quads, FM noise figure, transistor parameter tracer.

SEPT 69. Tunnel diode theory, majic tee, soldering techniques, wave travel theory, cable shielding, transistor theory, AM noise limiter, AFSK gen, transistor amp debugging, measure meter resistance, diode-stack pwr supply, transistor testing, 2½W 6M tx, HX-10 neutralizing, capacitor useage, radio propagation, AM mod percentage, extra class license study (part 8), 3-400Z linear, ATV vidicon camera, 2 transistor testers, FET compressor, rf plate choke.

OCT 69. Super gain 40M ant, FET chirper, telephone info, scope calibrator, thyrector surge protector, slower tuning rates, identify calibrator harmonics, FM adaptor for AM tx, CB sets on 6M, proportional control xtal oven, xtal filter installation, Q-multiplier, transceiver pwr supply, extra class study (part 9).

NOV 69. NCX-3 on 6M, IF notch filters, dial calibration, HW32A external VFO, 6M converter, feedline info, rf z-bridge, fm mobile hints, umbrella ant, 432-er tx (part 1), pwr supply tricks with diodes, transistor keyer, transistor bias design, xtal vhf sign gen, electronic varlac, SB33 mods, extra class study (part 10), SB34 linear improvements.

DEC 69. Transistor-diode checker, dummy load/attenuator, tuned filter chokes, band-switching Swan 250 & TV-2, 88mh selectivity, match exercizes, rtl xtal calibrator, transistor pa design, hv mobile p.s., 1-10 gHz freqmeter, CB rig on 6M, extra license study (part 11), 1970 buyer's guide.

JAN 70. Transceiver accessory unit, bench power supply, SSTV color method, bass-tuned center-loaded ant, 6M bandpass filter, extra license study (part 12, rectifier diode useage, facsimile info.

FEB 70. 18-inch 18M dipole, 6M converter, high-density pc board, camper-mobile hints, 2M freq synthesizer, encoding/decoding for repeaters, DX-35 mods, panoramic vhf rx, variable-Z HF mobile mount, extra license study (part 13), linear IC info, qrp 40M tx, IC Q-multiplier.

MAR 70. Gdo applications, charger for drycells, FM freq meter, pc board construction, ham fm standards, cheap rf wattmeter, multifreq fm osc, "IF" system modules (part 1), Six-er mods, gdo dip lite, Motorola 41V conversion, cw monitor, buying surplus logic, SBO-23A sonobuoy conversion, GRC-9 rx/tx conversion, extra class study (part 14), intro to vhf fm.

APR 70. Noise blanker, 2M hotcarrier diode converter, repeater controller, understanding COR repeater, 7/8-wave 2M ant, extra class study (part 15), inexpensive semiconductors, renovating surplus meters, linear amp bias regulator, hi performance if amp & agc system, SSB bfo for shortwave radio, vacuum tube load box, general fm dope & repeater guide, megger-ing your ant.

MAY 70. Comments on "fm docket" #18803, future of cw, fm-am rx aligner, 5/8-wave verticals, using 2M intelligently, auto burglar alarms, pwr supplies from surplus components, "IF" system modules (part 2), vhf FET preamps, educated "idiot" lites, postage-stamp 6M tx, extra class study (part 16), Bishop IPNL, low-band police monitor, mobile cw tx, Wichita auto-patch.

JUNE 70. DDRR ant, vfo circuit, remote SWR indicator, indoor hf vertical, two rx on one antenna, environment & coax loss, 2-el trap verticals, buying surplus, two 40M qrp tx, 21dB 2M beam, extra class study (part 17).

DEC 70. Solid-state vhf exciter, delta-fre control for SSB, 2M transistor FM tx, HW100 offset tuning, "little gate" dipper, 3-500Z hf linear, general class study (part 8), "transi-test" (no good – errors!), transistor p.s. current limiter.

JAN 71. Split fones for dxing, Heath Ten-er mods, cw duty cycle, repeater zero-beater, HEP IC projects, 10-15-20M parabolic ideas, lightning protection, IC rx accessory, attic ants, double-balanced mixers, permanent marker tool, ham license study questions.

FEB 71. Metal locator, varactor theory, AFSK unit, SSTV patch box, ATV hints, RTTY tuning indicator, tone encoder/decoder, 220 MHz converter, SSTV magnetic deflection, IC code osc, 6M tx beeper, general class study (part 6), RTTY intro, perf-board terminal, low-ohmmeter.

MAR 71. IC audio filter, IC 6M converter, trap vertical ideas, digi counter info, surplus equipment identification, hf linear, simple fone patch, repeater audio mixer, digi RTTY accessories, coathanger gndplane, general class study (part 7).

APR 71. Intro to fm, noise blanker, repeater problems, Motorola HT mods, microwave repeater linking, digital ID unit, Tunadar 2M fm rx/tx, repeater directory, fm marketplace, meter evaluater, varactor modulator, simple sig gen, touchtone hookup, hf preselector, 10M 12W tx.

MAY 71. 75M mobile whip, 2M preamp, transistor amp design, 10M dsb tx, portable fm transceiver directory, audio compressor clipper, transistor LM frequmeter, 450 MHz link rx, simple af filter, 1-tube 2M transceiver, surplus 2M power amp, general class study (part 8).

JUNE 71. 2M beam experiments, 3 el 2M quad, multi-band dipole patterns, weather balloon vertical, pocket-pager squelch, two-er vfo, tuning mobile whips, transistor pwr supply, capacity decade box, 40M gain ant, general class study (part 9).

JULY 71. IC audio processor, audio sig gen, cw filter, 2M fm osc, 2M collinear vertical, FM supplier directory, Motorola G-strip conversion, transistor beta tester, general class study (part 10).

AUG 71. Ham facsimile (part 1), 500 Watt linear, dimensions for July collinear, 4-tube 80/40 station, vfo digi readout, Jupiter on 15M, general class study (part 11), pink ticket wavemeter.

SEPT 71. Transformerless power supplies, solid state tv camera, IC substitution, two rf wattmeters, IC compressor-agc, multichannel HT-200, ham facsimile (part 2), causes of manmade noise, vfo with tracking mixer, general class study (part 12), transistor heat-sinking, IC pulse gen, fone-patch isolation, hod wattmeters.

OCT 71. Emergency repeater car, tranceiver power supply, predicting meteor showers, digi switching, reverse-current battery charger, passive repeaters, earth grounds, audio "tailoring" filters, Swan 350 mods.

NOV 71. 3-el 75M beam, motor-tuned gndplane, 2M gain vertical, transistor biasing, split-site repeater, fox-hunting, audio filter, transistor/diode tester, xtal tester, 6M kw amp, 10-15-20M quad, transistor pi-net final, ant feedline, communications dbs, 2300 MHz exciter.

AUG 72. SSTV intro, speech processor, fm repeater info, test probe construction, GE progline ac supply, 432 rf testing, preamp-compressor, Six-er mods, fone patch, Ten-er info, solar info, SCR regulator for HVPS, "ideal" xtal osc, fm rx adaptor, auto theft alarm.

SEPT 72. Plumbicon tv camera, WWVB 60 kHz rx, cigartube sig gen, cw active filter, rf testing at 1296-3500 GHz, balun ant feed, transistor power supply, IC 6M rx, IC fm/am detector (part 2), active filter design (part 3), K2OAW freq counter (part 3), 2M freq synthesizer (part 1).

OCT 72. Corrections for Aug. fm rx adaptor, 2M freq synthesizer (part 2), 6M transistor vfo, nano-ampere meter, time-freq measurement (part 1), active filter design (part 4), repeater timer, extra-class Q&A (part 3), balloon vertical, ID gen, time delay relay, 432 filter ideas, DC-AC inverter, hc-diode converter, rtl decade and nixie driver, plus-minus supply for ICs.

NOV 72. Hf transistor power amps, RTTY selcal, IC trf rx, transistor keyer, emergency power, 220 MHz preamp, double-delta ant, simple converter using modules, hf RF tester, "lumped line" osc, 2M freq synthesizer (part 3), K2OAW counter errata, 2M preamp, extra class Q&A (part 4), hi-Z voltmeter, Nikola Tesla story, vhf swr meter, transistor regen rx, 432 SSB transverter, AC arc welder, intro to computers, hybrid am modulator, HR10 rx mods, 10M transistor am tx, 40M gndplane, IC logic demonstrator, overload protection, if/rf sweep generator, digi freq counter, aural tx tuning.

DEC 72. SSTV scope analyzer, 2M fm rx, tone burst encoder and decoder, universal if amp, autopatch hookup, LM380N info, voltage variable cap info, 2M 18 watt amp, SSB modulation monitor, xtal freq/activity meter, 10A var. dc supply, transmission line uses, radio astronomy, inductance meter, 75 to 20M transverter, LED info, 40M preamp, transistor vfo, 1972 index, 2M preamp.

JAN 73. HT-220 touchtone, 3-el 20M yagi, 50 MHz freq counter, speech processor, 2-tone gen, fm test set, tilt-over tower, 6M converter using modules, tuneable af filter, six band linear, 10M IF tuner, diode noise limiter, cw/ssb agc, HW22a transceiver 40M mod, HAL ID-1 mod.

FEB 73. CW id gen, tone operated relay, toroidal quadrature ant, active filter, time freq measurement (part 2), repeater timing control, SSTV circuits (part 1), 2M converter using modules, multifunction metering, FET biasing, freq counter preamp, TR22 hi-power mod, transistor rf power amps (part 1), light bulb rf power indicators, 75A4 filters, capacitance measurement, Gonset 201 mod, world time info.

APR 73. FM deviation meter, 2M FET preamp, two 2M power amps, repeater control (part 1), repeater licensing, European 2M fm, fm scanner adaptor, RCA CMU15 mods, lightning detector, cb alignment gadget, transistor rf power amps (part 2), repeater economics.

JUNE 73. 220 MHz sig gen, uhf power meter, repeater licensing info, RTTY autoswitch, 40M hybrid vfo tx, ant polar mount, 10-15-20M quad, K2OAW counter mods, double coax ant, ham summer job, tone decoder, field strength meter, nicad battery pack, ohm meter, FCC regs (part 1).

AUG 73. Log-periodics (part 1), tone burst gen, rf power amp design, transistor radio intercom, 160M ant, SSTV monitor, low cost freq counter, VOM design, qrp 40M tx, 432 MHz exciter, fm audio processing, FCC regs (part 3).

SEPT 73. Repeater control system, log-periodics (part 2), 2M rx calibrator, PLL ic applications, TT pad hookup, Heath HW7 "s" meter, Oscar-6 doppler, 2M coaxial ant, 2M converter, IC keyer, measure ant Z, FCC regs (part 4).

OCT 73. GE Pocketmate mods, microwave freq measurement, CA3102E 2M frontend, 2 kw hf linear, rf wattmeter, meter reps'r, 60/40 dipole, IC "hi" gen, vhf freq multiplier, FCC regs (part 5).

NOV 73. 450 MHz exciter, intro to ATV circuits, nicad voltage monitor, autopatch connections, IC meter amplifier, TR22 ac supply, indoor vertical, IC af filter, momentary power failure protection, 160M ant acoupler, Motorola HR info, SSTV-1BB, Class-B af amp, FCC regs (part 6).

DEC 73. Code speed display, 2M kw amp, IC keyer, 8038 waveform gen, helical resonator design, sensitive rf voltmeter, proximity control switch, IC tester, sequential tone decoder, 2M portable beam, electronic calculator math, cw filter design, FCC regs (part 7).

FEB 74. SSTV monitor info, IC audio amps, scope sweep gen, 15/20M vertical, telephone line control system, pc board construction, var-Q af filter, blown-fuse indicator, 40m cw stn with Ten-Tec modules, simple preamp-compressor, single-IC rx, "432-er" final assembly, transistor keying circuit, 7-segment readout with nixie driver.

APR 74. Vox for repeaters, tone-operated relay, hf transverter, 10-to-2m tx converter, remote control panel for scanner, RCA fm tx tuning, subaudible tone gen, FCC regs (part 9), Repeater Atlas.

MAY 74. Cd car ignition, audio compressor info, interference suppression for boats, auto burglar alarms, 2m ic preamp, 10m fet converter.

JULY 74. 4-1000A linear, universal freq gen, universal afsk gen, 555 IC timer, 80M phased array, 135 kHz-432 MHz preamps, 10M qrp am tx, 3000 vdc supply, how to read diagrams.

AUG 74. Toroidal directional wattmeters, 480 MHz FET preamp, use gdo to find "c", Trimline tt pad hookup, R390 & R392 rx mods, tracking cw filter, aural voltmeter, universal regulated supply, sstv scan converter, ttl logic problems, ID timer.

SEPT 74. MOSKEY electronic keyer (part 1), ex warning system, Heath 10-103 scope mods, qrp 6M am tx, rf speech clipper, audio noise limiter, wx satellite on SSTV monitor, universal IC tester, miniature rig construction, tower construction, infinite rf attenuator, electronic

(More)

photo flash ideas, IC "select o ject."

OCT 74. Microtransistor circuits, synthesizer HT 220 (part 1), repeater government, regulated 5 vdc supply, fm selcal, removeable mobile ants, Motorola metering, 2M vertical collinear, Motorola model code, 2M coaxial dipole, 1.6 MHz if strip, MOSKEY electronic keyer (part 2), carbon mike circuit, hi power to pass filter, 6M preamp, 3 wire dipole, ATV sync gen, NCX 5 mods, mobile whip for apartment dwellers, sstv auto vertical trig.

NOV 74. K2OAW counter update, regulated 5 vdc supply, wind direction indicator, synthesized HT 220 (part 2), 20M 3-el beam, autopatch pad hookups, double-stub ant match, novice class instruction, digi swr meter (part 1), 6M converter (1.6 MHz if), "C bridge," MOSKEY electronic keyer (part 3), Aug. sstv scan converter errata, repeater off-freq indicator.

DEC 74. Care of nicads, wind speed/direction indicator, wx satellite video converter, electronic keyer, hints for novices, unknown meter scales, SSTV tape ideas, TTL logic probe, public service band converter, tuned-diode test receivers, digi swr meter (part 2), telephone pole beam support, rhombic antennas, 1974 index

FEB 75. Heath HO-10 scope mod for SSTV, electronic keyer, digital satellite orbital timer, Oscar 7 operation, satellite orbital prediction, Heath SB-102 mods, comparing FM & AM, repeater engineering, Robot 80-A sstv camera mod, neutralizing Heath SB-110A, "Bounceless" IC switch, tape keyer for cw tx.

APR 75. $50 walky for 2M, 2M scanning synthesizer, 88 mH toroid info, 8-function repeater controller, nicad battery precautions, TR22C preamp, telephone attachment regs, Guide to 2M Hand-held Transceivers, 2M 7-el beam, basic telephone systems (part 1), 10 min ID timer, modified hf Hustler mobile ant for 2M, 15M quad modified for 20M, 2M collinear beam, R-11A surplus rx conversion, 5/16 wave 2M ant, Hellicrafters SX-111 rx mods, 160M cw tx.

AUG 75. 146/432 MHz Helical ants (part 2), 10 min ID timer, digi swr computer (part 1), debugging rf feedback, DVM buyer's guide, wx satellite monitor, cmos "accu keyer," pc board method, sweep-tube final precautions, compact multiband dipoles, small digital clock, accessory vfo for hf transceiver, modern non-Morse codes, multi-function gen, 2M scanning synthesizer errata, KP 202 walky charger, 10M multi-element beam.

SEPT 75. Calculating freq counter, wx satellite FAX system (part 1), IC millivoltmeter, three-button TT decoder, troubleshooting sstv pix, 40M dx ants, 146/432 MHz helical ants (conclusion), digi swr computer (conclusion), reed relay for cw bk-in, NE555 preset timer, power failure alarm, portable qrp rig power unit, precision 10 vdc reference standard, 135 kHz if strip, telephone handsets with fm transceivers, Motorola T44 tx mod for ATV, 0-60 MHz synthesizer (part 10, ham radio PR).

OCT 75. A deluxe TTY keyboard (part 1), Op Amps: a basic primer, an introduction to microprocessors, 2m Synthesizer (conclusion), Satellite Fax System (conclusion), regulated supplies (dispelling the mystery), Digital Logic made simple, FCC interview, a contest uP system, digital clock time bases, the operating desk, QRP 432, ham PR.

NOV-DEC 75. Blockbuster double issue! Flip-flops exposed, breakthrough in fast scan ATV, strobing displays is cool, the tuned lunch box (antenna tuner for HF transceivers), a deluxe TTY keyboard (part 2), the 127' rotating mast, less than $100 multi-purpose scope for your shack (part 1), predicting third order intermod, feedline primer, QRMing the Third Reich, why tubes haven't died, instant circuits – build your own IC test rig, the K2OAW synthesizer PROM-oted, a ham's intro to microprocessing, Ground Fault Interrupter (a keep alive circuit for yourself), a $1 strip chart recorder, an even simpler clock osc., the Fun City surplus scene, updating the Heath IB-1101 counter, 256 pages!

Since there's little to get stale in back issues of 73 (our magazine is not padded ... like others ... with reams of activity reports), you'll have a fantastic time reading them. Most of the articles are still exciting to read ... and old editorials are even more fun for most of the dire predictions by Green have now come to pass. Incentive licensing was every bit the debacle he predicted ... and more. You'll really get a kick out of the back issues.

BACK ISSUES

73 MAGAZINE CLASSICS

issues containing hundreds of articles & projects

GREAT FOR NOSTALGIA BUFFS

SEND TO 73 BACK ISSUES – PETERBOROUGH, N.H. 03458

2/77

☐ JUNE 63	☐ JAN 70	☐ JAN 73
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Ken Cole W7IDF
P.O. Box 3
Vashon WA 98070

Talk About DX--WOW!

- - you just never know

Twenty meters seemed unusually quiet after listening to locals and heavy static crashes on eighty for an hour, but it was late and the middle of the week. When I had changed bands and flipped the antenna coax switch under the desk, it sounded as though propagation had been cancelled for the evening. The swr checked out at a normal 1.2 to 1.0 so I assumed the antenna was still up and connected. CQ brought no reply, and a careful headphone search across the band for another diehard was fruitless. Inactivity was at a peak.

Patience and a hundred Watts into a vertical verge on fantasy when you need a kilowatt and a four element quad, but with freaky conditions you just never know, so I persisted. Nothing. A few hours before I had been fascinated by the fine quality of the pictures from the Viking on Mars – a low power TV transmitter 250 million miles away. Irony. Finally I parked the transceiver on 14.225, set the Scanalyzer sweep width on 50 kHz and idly sorted through the QSL file, musing on yesteryear's hard-won souvenirs of youth, all-night vigils, forty Watts and a good Zepp.

Just as I was thinking about shutting down I heard a clear "Hello, hello." Precisely on frequency, nice audio. Nothing on the scope, and the S meter didn't move, but I recalled fiddling with it earlier in the evening when eighty was so noisy. And on a quiet band the Yaesu was notably kind to the most minute signals.

"Hello, hello" again, then silence. "W7IDF, near Seattle," I said hopefully. "Name's Ken. You're very weak but perfectly readable."

The reply was prompt. "Thank you. I could use a little help here. Are you busy?"

"Okay. You are the only signal I've heard on the band in the last half hour. Good quality, just weak, and I didn't get your call."

"Thanks. This is AC25OLS. Alpha Centauri Twenty Five Outer Limit Survey. If you don't mind, I'd like to ask you a few questions."

"That's a fascinating call, old man. Been watching a lot of 'Star Trek' re-runs lately?"

"You lost me there, but never mind. This is a routine solar systems check and we appreciate your cooperation. By the way, you're only the third response I've had from this planet; the first two were W6s and initially helpful with information about your society structures, but after a bit they indicated definite hostility. Something to do with the ARRL Countries List. Now then, I'll just run down this form and we'll fill in a few blanks. Okay?"

"Listen, if you guys are having a party over there, that's fine, and good luck, but why don't you just let the rig cool off and play a little poker? Or spin-the-bottle if it's YL night. This ain't old-timey CB, good buddy."

"Please, I'm allowed only eight hours scanning and two hours after entering synchronous orbit here, so, if you don't mind . . ."

"Great. I suppose you're going to tell me next that you learned English at U.C.R.A. What are you guys really up to?"

"Language is irrelevant, obsolete for aeons. We're communicating by the standard process of heterodyning brain waves. It's simple but obviously you wouldn't understand. No offense. Now, how about some answers?"

"Okay, I'm game. Up to a point. AC25OLS from W7IDF, and if anyone wants to break in I'd be grateful. Go ahead."

"Well, the main assignment: Is there intelligent life on your planet? What I got from those W6s pretty much confirmed my suspicions."

"Don't jump to conclusions; California's another world, and your contacts probably were in L.A. to boot. Did they leave you a little confused?"

"I mentioned that we had opened a file on your recent upper atmosphere nuclear explosions and asked if they could give me any explanation. What they told me was depressing – this business of you guys killing each other in wholesale quantities every generation, and killing other life forms for fun. You got off on the wrong foot some-

where. And all that stuff about racial antagonism, fortified political fencing all over the planet, parochial language structures perversely blocking communication – weird, man! Any comments?"

"About intelligent life on Earth? I used to think there was, but by the time I got into long pants I was very doubtful. Haven't seen much evidence of intelligence lately, but I may have missed something."

"I see. Let's try to get something specific here, so who would you say is the wisest man on the scene today?"

"Hope nobody is taping this. Well, you asked a tough one, and I really don't know what to say. Woody Allen, I suppose. I would have said Stan Freberg a few years ago – and I didn't know how to spell his name then either – but he's kept a pretty low profile since that business of painting airliners to look like locomotives."

"I don't get it."

"Some PR assignment from Western Airlines I think. They wanted a scheme to make people think their planes were as safe and reliable as trains. That was before Amtrak."

"I think we're getting off on the wrong track here. Another item – we've noticed some miscellaneous junk orbiting Mars, and now you've got a primitive sensor device set up on the surface there. How about that?"

"Alfa Charlie Two Five Oscar Lima Sierra from W7IDF. This is going to look great in the log, Al. About the Mars lander, I cannot tell a lie; we done it. I think it was timed to celebrate two hundred solar orbits under our own flag, without a failure. Going around, I mean."

"Curiouser and curiouser. Your planet already has about 560 million orbits in the records at the main office, so what's so great about two hundred? Never mind, I'll just put down 'responsibility accepted' and you probably won't hear anymore about it. But off the record, what was the real reason?"

"Beats me. We have a lot of problems right here we can't seem to solve. I heard some rumor about dumping our nuclear waste products on uninhabited planets, but who knows? Just curiosity I suppose."

"Whaddya mean, who knows? You said it was your lander."

"Well, our technologies are symbiotic and accelerating. The result is we're already up to our trifocals in astonishing inventions, horrifying weapons and new taxes. Those pictures from Mars are great, but I don't know where we're going really, or why. Guess that's what I mean. I'm dumb; go ask a scientist."

"Sounds worse than I thought, but cheer up – you guys are new at the game. A recent check at this station reported no activity at all, just random life forms too elementary to allow communication. Let's see now – a simple question about your interplanetary probes: How are they powered?"

"Chemicals. Hydrogen and oxygen for the rockets, maybe, and to produce them I suppose some nuclear plant output is involved, but most production is still based on fossil fuels. And some hydroelectric wattage – courtesy of gravity. But the big money's in fossil fuels."

"Figures. The same old natural resource rip-off, but don't get discouraged – you'll soon be into solar energy. Anyway, no sweat for the galaxy. Certainly you haven't broken the speed-of-light barrier yet."

"Doubt it. Maybe on the freeways now and then. Why don't you check with Caltech or somebody? Like I said, Al, it's moving so fast us peasants don't know up from sideways anymore. Hey fellas, any breakers?"

"Don't apologize if science isn't your bag. As a matter of fact, all the significant data are being collected and banked automatically; it's just nice for me to have a contact now and then. Sometimes this job gets on my nerves. Oh yes, one bad thing about all these sensors: They're totally insensitive to motivation phenomena. With immature social systems that tend to go off in kinky directions, it can get hairy for our prognosis processor, so tell me what's behind the emphasis on life-destructive devices. Why all the fancy weaponry?"

"AC25OLS and anyone else who would please join us, from W7IDF. I don't think that was a very nice thing you said there, Al, about immature social systems. But to answer the question: I really don't have the faintest idea. In my lifetime there have been four major wars, and yet I've been all over this planet and rarely met anyone I didn't like. Also, don't get the idea that we're not law-abiding folks – just take your clothes off publicly and unless you're getting paid to do it, I guarantee you'll find yourself in the pokey before you can say Buck Rogers. About the ICBMs and red telephones, I'd level with you, but I'm as much in the dark as you are."

"See what I meant about you guys being a little weird? Sounds like science fiction and makes less sense. Well, time's running out but thanks for the chat. I'd like to stick around but I have to get to the next solar system. You know how it is, 'promises to keep, and miles to go before I sleep.' Bet that surprises you."

"Not really, Al. Nothing surprises me much anymore, and also I noticed that when I thought I was switching to the twenty meter antenna, what I did was put the rig on the dummy load. Anyway, it's long past midnight, so have a nice day." ■

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An Automatic BC Squelch

- - another use for your 2m squelch

If you have ever wished you could listen to your car's commercial broadcast receiver without missing a call on your transceiver or scrambling to twist volume controls when a ham signal pops in, the QRM Zapper is the answer to your problem. The QRM Zapper will silence the broadcast receiver whenever your transceiver picks up a signal and then restore the broadcast receiver a few seconds after the transmission ceases. The Zapper also silences the car radio while you transmit, so you can enjoy a QSO without being QRMed by the news.

While the original Zapper was designed to be used with an Icom IC-22A, any transceiver is capable of furnishing the two trigger signals required to make the Zapper work. The triggers have to be negative going, so the transmit trigger is obtained from the microphone switch by connecting to the hot (ungrounded) side of the switch. In the Icom IC-22A, the receive trigger is taken from the emitter of Q26. Q26 drives the receive signal lamp when an incoming carrier breaks the squelch, so the emitter voltage drops to near ground potential and satisfactorily serves as the source for the receive trigger.

For transceivers without the carrier lamp feature, the receive trigger can be picked up from some point in the squelch or AGC circuits where the voltage swings from near 5 V or higher to ground potential with an incoming signal. If necessary, a simple transistor switch can be added to invert a voltage from one of these sources and amplify its swing to meet the requirements for the receive trigger.

The QRM Zapper is designed around a 555 integrated circuit, and it silences the broadcast receiver by switching off the battery voltage to the broadcast receiver. Either trigger from the transceiver starts the action of the timer. Triggering the 555 removes the car battery source from the broadcast radio. The battery is reconnected a few seconds after the end of the trigger signal. A new trigger applied while the 555 is timing out stops the rundown of the timer, cancels the elapsed rundown time and causes the battery to remain disconnected, so QSOs free of QRM from the broadcast receiver are enjoyed by electronic means rather than manual adjustments.

The 555 timer is operated in the missing pulse detector circuit shown in the 555 data sheets (refer to Fig. 1). Q1, a small PNP transistor, prevents the RC timing circuit R1-C1 from charging until the trigger applied to the base of Q1 is removed. This forces the 555 timer IC1 to begin its timing action after the carrier ends or the microphone switch is released; it delays the connection of the car battery to the broadcast radio for the few seconds necessary for the RC circuit to charge. The beginning of the negative going trigger at pin 2 of IC1 causes the output pin 3 to go high and remain in this state until the RC timing circuit has charged to a certain level. The output at pin 3 of IC1 controls a 2N4901 transistor switch which is in series with the broadcast radio battery source. When pin 3 is high, the switch is open. When pin 3 is in the low state, the switch is closed and the broadcast radio is on. Therefore the Zapper silences the broadcast radio for the duration of the trigger signal plus the time it takes to charge the RC timing circuit.

The trigger signals connect to the cathodes of the two 1N4001 trigger diodes, D2 and D3. The diodes isolate the transceiver circuits from the Zapper and from each other while coupling the trigger signals to the trigger pin of IC1 and the base of Q1. IC2, a 555 in a monostable circuit, is triggered by the end of the output pulse of IC1. IC2 generates a 0.1 second holdoff voltage in the trigger circuit immediately following the timed period. The holdoff voltage prevents any switching disturbance in the broadcast radio battery circuit from retriggering IC1.

Originally the Zapper was operated with the car battery voltage on the ICs, but IC1

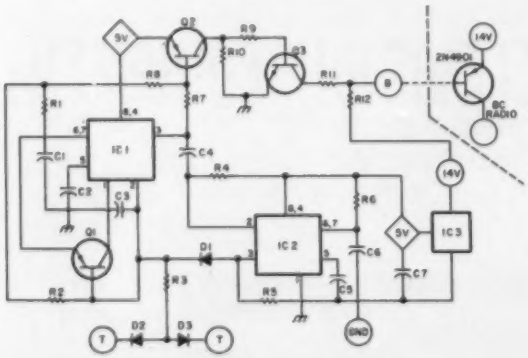
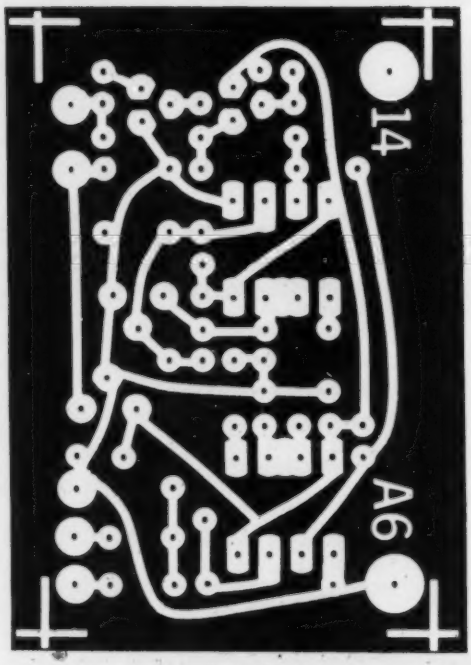


Fig. 1. Schematic of the QRM Zapper.



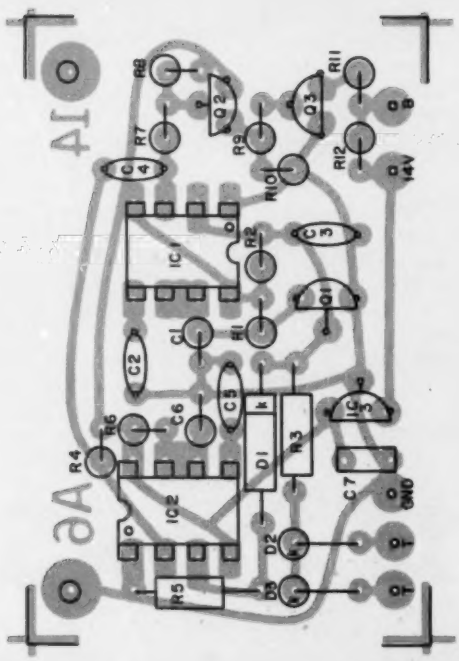


Fig. 2. Component layout of QRM Zapper printed circuit board.

would intermittently self-trigger the broadcast radio and sometimes silence it continuously. Several brands of 555s were tested but they all performed the same. The solution was to operate the 555s at 5 V. IC3, a 78L05 miniature voltage regulator, supplies the 5 V. A pair of small transistors, Q2 and Q3, are used to interface between the 5 V output of IC1 and the 14 V level of the 2N4901 switch. The 2N4901 transistor is used instead of a relay and is capable of handling 5 Amps.

The three ICs and the three small transistors with their circuit components are mounted on a small printed circuit board. The single sided board measures 1.2" x 1.9". The 2N4901 transistor and heat sink are mounted separately. A Wakefield 6103 heat sink was used, but any small heat sink for TO-3 style transistors can be substituted since there is very little heat developed by the 2N4901 transistor.

One wire runs between the PC board and the 2N4901 transistor, connecting the solder pad marked "B" on the PC board to the base terminal of the transistor. The emitter of the 2N4901 connects to the car battery positive source, and the collector is wired to the broadcast radio positive battery lead. This places the transistor switch in series with the car battery and the broadcast receiver.

The QRM Zapper can be assembled in its own box or preferably installed inside the broadcast receiver case. The small size of the printed circuit board should make it easy to find mounting room inside the radio cabinet. The 2N4901 transistor on its heat sink can be installed inside or outside the radio by drilling a pair of mounting bolt holes through one of the vertical sides of the heat sink. Number 4 machine screws are large enough to hold the transistor. The metal transistor case is the collector connection, so the 2N4901 has to be insulated from the heat sink with a mica insulator.

Before installing the printed circuit board inside the radio case, remove the wire(s) connected to the cold side of the broadcast radio's on-off switch and connect the wires that were removed to the collector of the 2N4901. This places the radio load in the switched output of the Zapper. Then solder two wires to the vacated lug of the on-off switch and connect one of these wires to the emitter of the 2N4901. Solder the other wire to the pad marked "14 V" on the printed circuit board. These wiring changes enable the broadcast radio on-off switch to also control the power to the QRM Zapper.

Two wires for the triggers are installed from the transceiver to the solder pads marked "T" on the printed circuit board. The Icom IC-22A has an accessory socket at the rear which was used for the trigger wiring so the transceiver could be disconnected and removed from the vehicle. If a socket

Parts List

C1, C6	4.7 uF, 20 V tantalum capacitor
C2, C3, C4, C5	0.02 uF, 50 V ceramic capacitor
C7	20 uF, 6 V tantalum capacitor
D1, D2, D3	1N4001 diode
IC1, IC2	555 IC
IC3	78L05 voltage regulator
Q1, Q2	3638A PNP transistor
Q3	2N3904 NPN transistor
R1	2.2 megohm, ¼ W resistor
R2, R4, R9	22 k Ohm, ¼ W resistor
R3	1 k Ohm, ¼ W resistor
R5	4.7 k Ohm, ¼ W resistor
R6	120 k Ohm, ¼ W resistor
R7	2.2 k Ohm, ¼ W resistor
R8, R12	560 Ohm, ¼ W resistor
R10	820 Ohm, ¼ W resistor
R11	100 Ohm, ¼ W resistor

The QRM Zapper board 14A6 etched and drilled is available from the CRS Company, P.O. Box 1125, Kent WA 98031 for $3.00. Completely assembled and tested boards are $10.00 from the same supplier.

Additional parts required: 2N4901 transistor, TO-3 socket, Wakefield 6103 heat sink, mica insulator, hardware, box and wire.

is not available on your rig, it would be wise to provide some practical way of disconnecting the trigger wires, such as installing a plug and socket or mounting a screw type terminal board at the transceiver.

The QRM Zapper can also be installed in its own case. A small box similar to an LMB number 00Z which measures 2-5/16" x 2-1/8" x 1-3/4" or a Radio Shack #270-235 box of slightly larger dimensions will easily contain the printed circuit board and the 2N4901 with its heat sink. If the broadcast radio has an in-line fuse holder, a Radio Shack #270-1281 in-line fuse holder can be used to connect the Zapper in series with the broadcast radio battery source. Connect the fuse holder leads to the 2N4901 transistor socket in such a manner that when the fuse holders are mated, the car battery is connected to the emitter and the broadcast radio lead connects to the collector of the transistor. Then connect a wire from the 2N4901 emitter to the 14 V solder pad on the printed circuit board. Connect the ground solder pad on the printed circuit board to the vehicle ground system.

All components, including the three ICs and the three small transistors, are soldered directly to the printed circuit board. Component locations are shown in Fig. 2. Most of the diodes and resistors are installed vertically, with one end of the body placed against the PC board and the other lead bent back along the body and inserted into its solder pad hole. The printed circuit board can be mounted with two #2 machine screws in the upper corners. Holes for this purpose are indicated in the foil pattern and shown in Fig. 2. The foil side of the board must be separated by any adjacent metal by at least 0.2" by the mounting hardware to avoid shorting out the Zapper. ■

LETTERS

from page 86

out here are maybe confused as to how come you ain't at *Byte*. If anyone asks, they are concerned, and if anyone is concerned, then maybe they have some feeling of bias for you; you won't lose anything by levelling.

Now, about *Kilobaud*: I think dividing off some of this really great I/O stuff from *73* and making two magazines is a mistake. In all fairness, I should say I've called the last five presidential elections wrong, excepting that I picked McGovern over Nixon. So much for batting averages. But here's my check for $12; you have and are doing a lot for ham radio and I sure want to see what is next out of the Wayne Green typewriter.

Hang in there; not many of us in the silent majority ever speak up, but we do write checks and buy magazines from newsstands and pull for the guys we *know* are wearing the white hats.

Arnold Senterfitt W6ESV
San Diego CA

If you're really interested, write Byte *about it . . . and I'll sure want to see what kind of an answer you get. I wonder how they can explain to readers what they did. – Wayne.*

THE LF-VLF CAPER

First I want to congratulate you on publishing such a fine magazine as *73*. The technical articles are written in first class style, and the advertising is well laid out and in good taste. The letter written by the fellow in Little Rock (the VLF caper) prompted me to comment on his discussion of the VLF frequencies. First of all, there is nothing secret or mysterious or "out of this world" about the LF or VLF frequencies. I have been doing solar flare propagation work at LF and VLF for about 5 years. Most of our studies are at 24 kHz and 27 kHz for the S.E.A. (Sudden Enchantment of Atmospherics) and at 18 kHz for S.E.S. (Sudden Enhancement of Signal). I have monitored and recorded every frequency between 15 kHz and 600 kHz with my RBA-7 equipment and have yet to hear recorded voice transmissions that speak no known earth language, or dogs barking at each other. What I do hear are military, commercial navigation, omega, and standard stations throughout the world. As far as the lack of design in VLF, the solar flare patrol division of the A.A.V.S.O. (The American Amateur Association of Variable Star Observers) has been using solid state receivers (home built) for years. We still rely on miniature miller coils, and have even designed an S.E.S. receiver for 18 kHz using a ceramic filter with an associated chart recorder interface. As for the lack of commercial gear available, I could list dozens of receivers that can tune "below the broadcast band," not to mention the Drake DSR-2 or the National HRO-500. If he really wants to know what the LF and VLF frequency spectrum is all about, he can purchase a copy of my book, *Propagation and Solar Flare Recording Handbook For The Ham, SWL, and Radio Astronomer*, which will be published in early spring by Tab Books. Again, keep up the good work.

Carl M. Chernan WA3UER
Tarentum PA

WRAPPERS

Having been an avid reader of your magazine for the past couple of years, I have not had need to write. I wait impatiently every month for each issue.

I wish to state unequivocally that I disapprove your dropping the brown wrappers that PROTECT the magazine. If they cost extra, please send me a bill. My latest copy arrived with the corner torn off on the bottom, and with bent corners on both the top and bottom that go through the whole magazine. This may seem picky, but my three year old back issues are all in better condition than my new magazine.

I also am complaining about the mailing label being pasted on the front, along with a postal sticker defacing the cover.

I hope sincerely that you print this, as I would like all those who agree that the practice of not protecting the magazine should stop, to send Mr. Green a letter.

Thank you for letting me get on the soapbox; I really hope you change your policy.

John P. Steiner
Worthington MN

Sorry OM, but a printer's strike forced the Holiday issue to be mailed without wrappers. Things will soon be back to normal; sorry again for the inconvenience. – Ed.

THREE MORE YEARS

The Holiday issue of *73* is great! I just got it yesterday and got an idea for my car's two meter antenna.

The article on the "Frumious Hexadecimal" is interesting but incomplete. I've been programming on IBM equipment for a living for about three years now, and in our shop, hex numbers come in many sizes: X, H (this one the author knows), F, and D. These are all indicative of the amount of storage taken up by the hex number. X indicates a single byte, a value from X'00' to X'FF' (0 to 255). H is a half word, or two bytes, and the numbers go from H'0000' to H'FFFF' or 0 to 65,535. F is for a full word, four bytes long, and D is a double word, eight bytes long. I have never seen anyone use just the quote marks to indicate that a number is hex, but it's an interesting idea.

In the same article, the author misses one of the neater properties of hex numbers. He takes the number H'39BD' and laboriously converts it to 14,781 decimal, then remarks how difficult the conversion into binary would be. Translating from decimal to binary is no picnic, but hex to binary is a natural. Simply take each hex digit and write it as a four digit binary number (to match hex 0 through hex F). Here, 3 becomes 0011, 9 becomes 1001, B is 1011, and D is 1101 for a translation from H'39BD' to B'0011100110111101' in less time then it takes to write this. (The B stands for binary.)

Also in this issue, I find someone willing to charge $4 for a deck of 25 cards in FORTRAN. Surely anyone with half an ounce of typing skill (even myself!) and access to a keypunch could punch these up in ten minutes or less. Let's see now, my installation figures that each card costs it 1.7¢, call it 2¢ with the "labor" involved. Prices may vary, but I see a 400-800% profit on each sale. How do you reconcile this exorbitant fee for such a simple function? Heck, I'll do it myself for half price. Send check or money order to Joe Larson, 1983 Strongs Avenue, Stevens Point WI 54481. Do I hear a dollar? Hang around a university computer center and you can probably do it even cheaper.

Now, if that $4.00 included the computer run of 15,000 pages or so, it would probably be well worth it.

Aside from all this, keep up the good work, Wayne. I've enjoyed *73* as long as I've been a ham, since 1964. Put me down for three more years.

Joe Larson WA9NDV
Stevens Point WI

TO FCC – NUTS!

Chairman of the FCC
York Street
Gettysburg PA

Dear Sir,

I am extremely interested and disturbed about the amount of time the Commission takes to process all amateur radio licenses. I have been licensed since 1961 1961 and I can understand, with the increased num-

Continued on page 126

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Briefs

from page 17

minute period would eliminate the problem of false alarms caused by test transmissions and accidental activation of the ELTs.) Postlethwaite told *73* that a major aircraft company has agreed to make all of their used tube radios available to repeater sites throughout the nation.

Once the ELT signal is detected, a low cost direction-finding unit designed by Postlethwaite is used to pinpoint the location. As a plus, this DF unit can be used by repeater groups to locate illegal transmitters and jammers. Watch future issues of *73* for articles on the Happy Flyers and a construction article on the DF unit, which can be built for under $50.

The Happy Flyers are seeking members and attempting to form groups throughout the country. At present, there are no squadrons east of Oklahoma. Anyone who is interested in their proposals is welcome to join, with no requirements of being either a ham or a pilot. There are no dues or membership fees. For further information, write to *Hartley Postlethwaite W86CQW, Electronic Search Education and Coordination, 1811 Hillman Ave., Belmont CA 94002.*

An "administrative delay" at the FCC in Washington has resulted in a two to three month holdup in the implementation of multiple choice code comprehension exams at regional FCC offices. Two high-placed spokesmen confirmed reports of a delay in the process of putting the duplication of new exam tapes out for bid.

At press time, the FCC estimated all offices will have the exams by the beginning of March. They will consist of a five minute "typical" QSO. After the copy is sent, applicants will be given a ten question multiple choice exam. The passing grade is 80%.

In September, a Denver resident visiting Colorado Springs and the Pikes Peak area drove to the 12,500' level of the auto highway on the Peak to do some hiking. Heavy clouds obscured the mountain and, in hiking, he stumbled and fell to a ledge located on the upper portion of the Bottomless Pit drop-off — a sheer cliff of 1300 feet. Unable to move, the hiker lay for 2½ days with a compound fracture of the leg, frostbite, and in shock, without food. Water he obtained by soaking a handkerchief in snow, and then squeezing it out.

The victim was rescued by the El Paso and Arapahoe Counties Search and Rescue Teams in cooperation with the US Army Medical Helicopter teams from Fort Carson CO, after being found by two members of the Pikes Peak Radio Amateur Association. The amateurs were members of the S&R Team and, with other area amateurs, had been in on the "man-hunt" since it began. Communications were provided by the PPRAA repeaters on 16/76 and 37/97 (highest amateur repeater in the world) and by the Telestar 87/27 repeater.

It required three rock climbing rescue teams to lower themselves by ropes 1000' to the stricken man, after which a further descent of 800' was necessary in order to permit a helicopter to transport the patient to the hospital. Lake Erie ARA *Newsletter*, Lakewood OH.

Conflicting reports abound on how the new 40 channel CB rigs are doing in FCC tests. *Electronic Engineering Times* reported most of the units submitted had failed to pass the new emission standards tests. But *Communications Retailing*, reporting on a CB symposium held during October in New York, quoted FCC Engineer Ed Schafer as saying better than 50% of the units submitted for test were meeting cabinet radiation specifications. At the FCC labs outside Washington, spokesman Frank Caperidge told *73* the tests show about 53% failing and 47% passing. Caperidge says there are six tests, with the cabinet radiation test a major stumbling block. Local oscillator radiation is measured with a field strength meter at 3 meters, and Caperidge says most of the 40 channel units that are failing can't meet the 5 mV specification. The FCC lab, at press time, was working overtime on the 500 units submitted for inspection, with 106 certified, and less than a month to go.

Northglenn CO has banned amateur radio towers. According to the Pueblo Ham Club Bulletin *Grid Leak*, an appeal is underway, after a lower court judge upheld the ordinance. Twenty-five witnesses appeared against the law, but the city government called no one. Despite the testimony supporting amateur radio and the need for towers, Judge Clifford Goebbel found against the hams. The appeal is expected to take at least a year.

In April, 1779, a group of mutineers took over the HMS Bounty . . . sending the Bounty's captain William Bligh and 18 crew members loyal to him on a 3 thousand mile journey to Timor, and back to England. The descendants of those who stayed with the ship are still on Pitcairn Island, a South Pacific land mass of 2.5 square miles, off the main sea-lanes, with a very poor anchorage so boats are infrequent. The only reliable means of communication with the outside world is amateur radio, through VR6TC, which is operated by Tom Christian. The main generator recently blew up and burned leaving the 150 islanders with small auxiliary generators, and a real energy crisis. Bert Moser W6HS is running a fund drive to buy a new generator for Pitcairn, and you can help by sending a contribution. Bert's address is 2153 Lyans Drive, LaCanada CA 91011. Thanks to *Overmodulation*, Bulletin of the Poinsettia ARC, Ventura CA.

The Concord Brasspounders Club, New Hampshire's oldest, helped 15 Novices get their licenses this fall. The Brasspounders were the first club to use *73*'s new *Novice Class Study Guide* and Code Tapes as part of a program designed to gain FCC certification for the *73* materials. Club secretary Nate Sanderson WA1RWP reports quick responses from Gettysburg, several father-son and husband-wife teams, and more classes in the works. (It's efforts like these that are making New Hampshire contacts a lot easier to come by. — Ed.)

If you're lucky enough to find yourself in Hawaii this winter, check out the amateur radio news being transmitted Monday nights over the state repeater system. KH6GQW puts the news together, and transmits starting at 8 pm local time over 28/88 Diamond Head, 34/94 Haleakala, and 22/82 Mauna Loa. "And that's the way it is . . ."

The FCC has suspended *all* license fees, after a US Court of Appeals ruling which invalidated the Commission's fee schedules. In a suit brought by broadcasting interests, the court found that the FCC had to justify all of its fees based on the cost of any given service. An FCC spokesperson told *73* the Commission decided it had no alternative but to suspend the fees effective January 1st, and launch a study into the legal and administrative implications of refunding fees collected under the current schedule. Following a US Supreme Court decision in 1974, the Commission established a new set of fees, while at the same time requesting legislative action to correct deficiencies in the laws that enable it to collect them. The FCC position, at press time, was that without an act of Congress, it could not collect *any* fees. It could then be some time before ham or CB license applications will require the $4 fee. As for refunds, most of the pressure is coming from broadcasters, whose license fees run into the thousands of dollars. The FCC budget is not expected to suffer, since the fee money goes into the general fund, with a separate budget for staff salaries and operating expenses. The plaintiffs in the case included the National Association of Broadcasters, the National Cable TV Association, the Electronics Industry Association, and Capital Cities Communications.

Obtaining insurance coverage for mobile rigs is becoming an exercise in frustration in many areas of the country. With the proliferation of rip-off artists coming on the heels of the CB boom, many insurance companies are refusing to insure mobile radios, at any price.

Until recently, automobile radios were covered under comprehensive policies as another item in the car. However, in most areas of the country, this has changed. Many automobile insurance companies are including clauses which specifically exclude 2 way radios from coverage. Depending on where you live in the country, you might be able to add an endorsement to your policy to cover the rig. This is completely up to the state insurance commissions (if the companies wish to offer it). In New Hampshire, an extra five dollars covers 2 way radios completely. Down in Massachusetts, which has the highest rate of automobile theft in the country, coverage can't be bought at any price.

Most policy endorsements carry requirements that the rigs be securely fastened to the automobile. (Quick-release mounts are *not* considered secure mounting.) Another requirement is that the car be locked. What this means is that in order to have your claim paid, it's necessary that the car show signs of forcible entry. If the thief who ripped off the rig had a master key or even put a coat hanger through a gasket, chances are that nothing will be collected since no signs of forcible entry will be evident.

The best way to get around these requirements used to be the personal property floater policy, which insured just the radio as a piece of property. *73* talked with several insurance companies who no longer offer them for two way radios. They draw no distinction between CB rigs, business band radios, or amateur units. Spokesmen at the companies pointed out that from the thief's eye view, they all look the same, as many hams will attest to after having their rigs ripped off or hearing "breaker 19" on the local repeater.

It's expected that if radio theft and the CB boom continue at their present pace, virtually no insurance will be available within the next couple of years for 2 way rigs. In the meantime, the best precautions that hams can utilize are locking cars, engraving driver's license numbers on rigs, hiding antennas, or, best of all, removing the rigs completely from the car when leaving it for any period of time.

More than a half dozen petitions have recently gone into the FCC hopper, with two others bounced. A proposal to force SSTV out of the phone segments on 20 meters was dismissed, along with a request that AM be banned below 10 meters. Both actions are not interpreted to mean actual death of the proposals, but instead the FCC's judgment that they can be covered under existing dockets, probably 20777 (bandwidth).

Other pending petitions include RM-2767, which asks for multiple trusteeship of club stations; RM-2768, to allow concurrent holding of Novice and Technician class licenses; RM-2769, requesting formation of a

Continued on page 138

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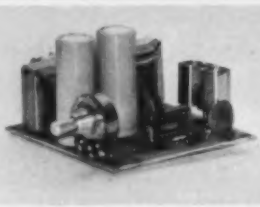

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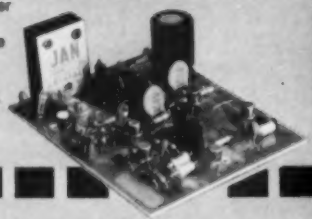

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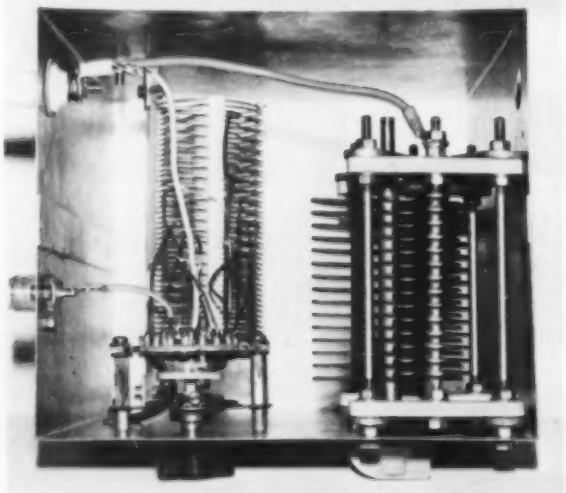
A problem encountered by most apartment-dwelling amateurs is that of radiating a good signal on all bands, without causing TVI, when facilities are available only for a wire antenna of random length. We have achieved this very successfully by adaptation of an antenna-tuning circuit previously used by VK6ZEH in commercial installations.

The necessary components were obtained as shown in Fig. 1 and the tuner assembled with the exception of the taps from the switches. A point worth mentioning here, in construction, is that the coil should be accessible to enable taps to be soldered on at any point around it.

It is essential that a good ground is available. Fortunately, at the 6DX apartment, the water system was all copper and its grounding properties good. Adjacent to the apartments was a filling station, with a very convenient tree at the back of the block. Permission was obtained from the flat owners, and, with the cooperation of the service station proprietor, 125 feet of wire became airborne at around 30 feet up. The length of wire is of no importance; anything more than 30 feet can be made to work on bands 80m to 15m. It is essential that the wire is placed in position and the end brought to the point where the tuner will be located. Any subsequent rearrangement will upset the system.

Reprinted from *Amateur Radio*, Journal of the Wireless Institute of Australia, October, 1974.



The photo clearly shows the construction and the heavy duty components used.

Tuning Procedure

The 80m band should be adjusted first. Place the capacitor in half mesh, the input tap about 10 turns up from the cold end, and the transceiver at midband. Feed a signal from a loosely coupled signal generator and run the top tap down the coil until a maximum S meter reading is obtained, then solder the tap in place. Now place an swr meter between the transceiver and tuner, using 50 Ohm coax. Apply low power from the transceiver and check for minimum swr. If it is necessary to move the capacitor considerably, re-center and adjust lower tap until the minimum swr is achieved. This can be done two ways: by switching off, moving, and rechecking, or by holding the lower tap with *well* insulated pliers and running up and down the lower section of the coil until the exact spot is found (WARNING – high voltages can be expected here; proceed with caution). Once the optimum position is found, by a very slight adjustment of the condenser, an swr of near 1.0 can be had from one end of the band to the other. If this cannot be achieved, select the lowest possible and readjust the top tap half a turn either way as necessary to lower the swr. When operating at the extreme end of the band, the swr should be no more than 1.2 and can be reduced by a slight adjustment of the capacitor.

The remaining bands are tuned in a similar manner. 28 MHz has not been included, as it is felt a suitable separate antenna can be erected and a separate tuner using smaller capacity and inductance constructed.

Features

One of the advantages of the tuner is that it can be adjusted to match any impedance offered by the long wire. It should be noted that in some instances, e.g., ours on 20m, the input tap is above the output tap due to the impedance being less than 50 Ohms.

No specific tap positions can be given as they are entirely dependent on the length, height and properties of the antenna. With a little

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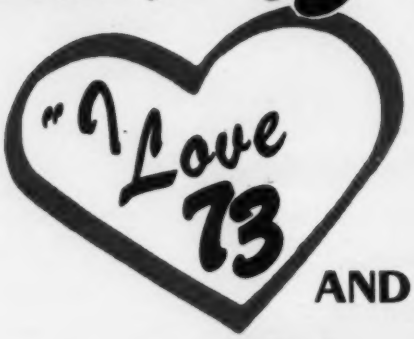

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patience, the ultimate can be achieved, all your signal generated being radiated and not wasted heating up the antennas.

Good construction practices should be followed, using heavy duty switches and a variable capacitor. The wiring should be bare copper wire and firm enough not to sag. Plastic covered wire, if touching, and the wrong tap selected for tuning up, will result in fusion of the wires together. The whole assembly should be enclosed in a well bonded and *grounded* metal box. By leaving off the ground, the swr will rise to as much as 2.5 to 1.

The system can be used to match a vertical antenna in the same way. Tests to date have shown the system to work very well, and the comment of DX stations is often of surprise when they hear that the antenna is only a long wire. Working portable in the NW, Europe has been worked with ease using a 60 foot wire 12 feet up and a fair ration of DX using a 125 foot wire 30 feet up. Good DX! ■

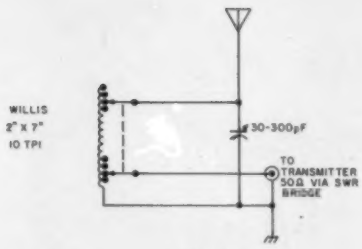


Fig. 1.

LETTERS

from page 116

ber of applications, how the time it takes can be multiplied. What I cannot understand is (since this process has been computerized) the time it takes to receive a license back from the Commission has not changed. In fact, it has increased!

When I got my Novice license in 1961, I waited six weeks from the time my test was mailed until my license came back. I am at present waiting for my Advanced class license (I was tested 10 Nov. 76) and I was informed by the examiner it would take about six weeks for my new license to come to me. This is the same amount of time it took to get my Novice back in 1961. HOW CAN THIS BE??

I would like to know how the routing and processing of the applications go when they leave the district office. Also I am interested in (since he has already proven himself by passing the exam and if he has a license), why can't the applicant be authorized to operate with the new privileges on a temporary basis until the new one has been issued?

There is no need to rush on a reply to this letter, because I will not be looking for an answer for the next six weeks.

Richard L. Swain

Here is a letter I sent to the FCC. The reason for doing the complaining should be rather obvious.

I am not trying to attack the entire FCC and say it is behind the times, because it is not. The fact is that the administrative section which does the actual processing and issuing of the licenses is GROSSLY inefficient and most likely is lacking in proper supervision.

I am a fourteen year veteran of the system (I am a member of the USAF), and I think I know how most government agencies work in their administrative sections.

I think the FCC could issue a temporary license at the field office or examination point for those who already have a license and callsign. Nothing makes most people madder than to order something pre-paid and have to wait two or three months for it to get to them.

I have discussed both subjects with several other amateurs and they agree all the way with me. What we would like to see is all others who have had the same problems voice their grievances or opinion on both.

Richard L. Swain K8AIT
Sawyer AFB MI

INSPIRATION

This is my first letter to any magazine, but the story on the five year old ham inspired me to write a few lines.

The first thing I might say is that my CB call is KET-5238, so this letter is not to cut down CB. It might step on a few toes in the ranks, but if the shoe fits, wear it.

It would seem that if a five year old can pass a Novice ham test, the people who want us to give up our standards as hams, by dropping the code and/or making the test simpler, should take another look.

I agree that we need new blood in the ham ranks, but we also must keep our standards high! If someone doubts this, they should look at other countries' licensing. Not every country has Novices for instance. So when a Novice goes to Germany, they do not license him at all. Can you or anyone else imagine a person with a "Communicator" license going to any country trying to get a license? It would probably be like going to another country with a CB license asking for an amateur license with General privileges.

Robert H. Partigianoni
WB5JZP/DA1PQ
APO NY

PHOOEY!

I must say "phooey to hams" in reference to those who don't acknowledge uP byters. My subscription to *73* started soon after I found I/O. It's a shame that a few people can't see past their ham dials, and into a world of logical bits. But of course everyone to their own – and mine is uPs. However, keep up the good work in *73* on both sections and maybe a few byters might just cross over and hit the airways.

To the byters I must pass the bytes on – while flying Delta over Georgia, an interesting gentleman (from TI) introduced me to TI's TMS9900 16 bit uP having a 3 MHz cycle time. With 17 vectored interrupts, full 16 bit capability on both A & D bus lines. And no special memories or ICs for system interfacing are needed.

The data sheets I have sure look like the PACE, 8080, and 6800 uPs have got a bigger brother. The cost of the 9900 is more but you save with the I/O and interrupt interfacing, program development, and program execution time.

Oh! And a new bipolar memory SN54S400 (S400) 4096 bit static RAM having a 75 ns R/W cycle.

Wow! Sure looks like '77 is going to be "heaven, next stop."

Francis T. L. Dossey
FPO New York

WIMU

Many thanks for the prize subscription to your magazine you contributed to the WIMU Hamfest. I won it in a 2 meter hidden transmitter hunt.

As a former president of this hamfest (when I was a K7 from Wyoming), I realize the difficulty of getting support and prizes to put on an event such as this. It is sometimes difficult to put on a good get-together without the generous support of ham dealers and the magazines. I want to extend to you my personal thanks for the subscription and for your support of our hamfest.

The WIMU Hamfest is for the hams in Wyoming, Idaho, Montana, and Utah. It is the largest and oldest hamfest in these western states. This year's event at Mack's Inn, Idaho was the 44th year it was held. We broke an all-time attendance record this year with a registration total of about 365. Perhaps a hamfest of this size is not too big by eastern standards, but considering the sparse ham population of these states, and the distances involved, the attendance is pretty remarkable. Some hams travel over 800 miles every summer to come to the hamfest.

Hal Bergeson W0MXY
Colorado Springs CO

FEEDBACK

I enjoyed reading the two part article about commercial marine radiotelegraph operators in the Nov. and Dec. issues. However, before any *73* readers get the wanderlust and strike out for such a career, a couple points should be made. First, there are about four times more operators available than ships. The Radio Officers Union is tighter than a drum and chances of more bodies entering in and thinning out the ranks are very poor right now. Also, on page 160, Dec. issue, the Coast and Geodetic Survey is listed as a source of employment. C&GS was done away with in 1965. National Ocean Survey in Seattle may be helpful. Also, MSA is not correct – should be MSC, Military Sealift Command. One in SF is called MSCPAC. I don't know the address.

Cliff Appel WB6AWM
Orangevale CA

TRIGGERED

I, too, was shot by Trigger Electronics, Dec. 21, 1974. I ordered high pass and low pass filters, and I was strung along until I got tired and

Continued on page 136

Novice Q&A

This column will be a monthly feature of 73 Magazine. It is hoped that it will be of assistance to beginners and old-timers alike. We only ask that your questions be kept as general as possible. We will try to answer all queries received. Please mail your questions to Technical Editor, 73 Magazine, Peterborough NH 03458.

Q. What is the correct procedure to use when measuring the grid current of a cathode-driven amplifier?

A. Measuring the grid current of a cathode-driven amplifier can be a delicate task, since it is a ticklish job to unground the grid sufficiently to permit a metering circuit to be used, yet still hold the grid at rf ground potential. The inherent inductance of most bypass capacitors permits the grid circuits to "float" above ground at some high frequency and, as a result, the amplifier exhibits instability and parasitics. This problem can be avoided with the metering circuit of the figure (A). The control grid is grounded with a 1Ω composition resistor, bypassed by a .015 pF disk capacitor. The voltage drop generated by the flow of grid current across the resistor can easily be measured by a millivoltmeter which is calibrated to read in terms of grid current. Individual grid current for each of a parallel pair of tubes may be measured by the circuit of (B) in the figure.

The internal resistance of the 0-1 dc milliammeter plus the series resistor E1 determines the maximum current in the order of 60 mA. This is very convenient, as the reading of the meter scale can easily be multiplied by 100 to obtain the actual value of current. When 100 mA flows through 1Ω, there exists a potential of 0.1 V across the resistor. The meter should read 0.1 V full scale to correspond to a grid current of 100 mA.

For example, with a Triplett #221-T (which has an internal resistance of 55Ω), the voltage drop across the meter itself is 0.55 V when 1 mA flows through it. To convert the milliammeter to a voltmeter reading 0.1 V full scale, a series multiplier must be added. A voltage drop of 0.1 V exists across a 100Ω resistor when one mA of current flows through it. The difference between 100Ω and 55Ω or 45Ω must therefore be added in series with the meter to convert it to read 0.1 V, full scale. On the other hand, placing the meter itself across the 1Ω resistor without the series multiplier will result in a full scale reading corresponding to 55 mA. Thus, if maximum grid current is below this latter figure, no series resistor is required for the meter. Conversely, high values of grid current produce greater voltage drop across the 1Ω resistor and larger values of series multiplier resistance are needed.

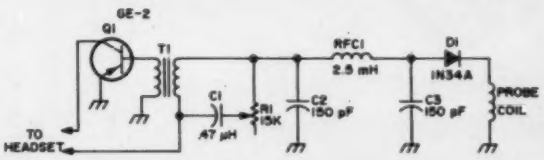
Q. What is a microwave radiometer and what does it do?

A. The microwave radiometer is a receiver of electromagnetic energy used to measure thermal radiation in the rf spectrum. Typical sensitivities of the order of 140 dBm are made possible by comparatively long post-detector integration time and provision for cancellation of receiver gain variation in the period of one observation.

These devices are mostly used in radio telescopes for measuring extra-terrestrial radiation and for passively detecting and identifying military targets (both ground and airborne).

Q. Is there a very simple, one transistor circuit for a CW monitor?

A. Yes, see the figure. For the tone desired, adjust potentiometer R1. Place the pickup coil anywhere near or in the transmitter. If the gadget doesn't "take off" immediately, reverse the primary winding connections of the transformer, which, incidentally, is a Lafayette TR-110.



Q. When operating a transmitting set containing a fan, must all covers be closed?

A. This depends on the design of the ventilation system. Large transmitters containing two or more air blowers are designed for "closed cover" operation within the ventilation system. Removing the covers allows the air (in some cases) to flow helter-skelter without maximum effect. On ham transmitters, especially SSB units of short duty cycle, there is generally no problem.

Q. Is it unusual that the final tubes of a transmitter must be replaced every four months? If so, what should be checked?

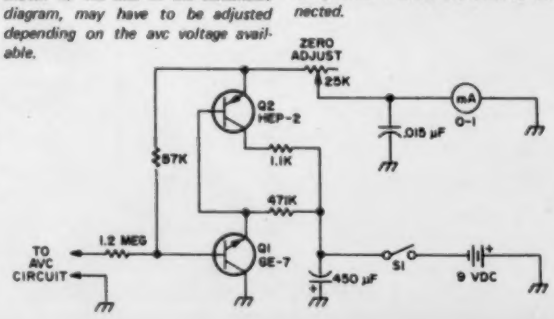
A. Yes, frequent tube replacement is unusual. First measure the bias to the final in accordance with the manual or a tube data sheet. Next measure the final plate voltage. If these do not check out (or are way off), then review your method of tuning. Running a transmitter into a poorly matched antenna, with its attendant high swr, does not help the final tube much. Overdriving the final tube is another way to shorten power tube life. Therefore, check the drive to the final, too.

Q. Is it possible to add a transistorized S-meter to an all-band Japanese-made receiver?

A. The circuit in the figure works well on most receivers and it is easy to connect. For Q1, the following transistors may be used: GE-7, SK-3011, NR5, TR-10, DS75.

For Q2: HE-1, SK-3005, TR-06.

The value of the input resistor, shown as 1.2 MΩ in the schematic diagram, may have to be adjusted depending on the avc voltage available.



Q. What modifications should be considered when modernizing a receiver?

A. First, replace the rf amplifier with a high-gain tube like the 6BZ6 – a new socket may be needed. The rectifier (5Y3GT) can be eliminated with a silicon plug-in replacement. Stabilize the voltage on the bfo (6J5) with a separate VR tube or zener diode. Add a product detector.

Q. When used in SSB work, the detector is usually referred to as "product detector." What is the reason for this?

A. Because the detector has an output amplitude which is proportional to the mathematical product of the amplitudes of its two inputs, carrier and modulating signals.

Q. Is there any way to use 90Ω coax cable with a vertical antenna which requires a 50Ω match?

A. Cut two parallel pieces of the 90Ω coax cable. Make sure they are the same length. By paralleling them the result will be 45Ω or so.

Q. Can #18 shielded wire be used to connect a doublet?

A. No. First, the doublet's 72Ω impedance does not match that of the wire. Second, shielded wire is not the same as coaxial cable. Finally, capacitance per foot is much higher with shielded wire than with coax.

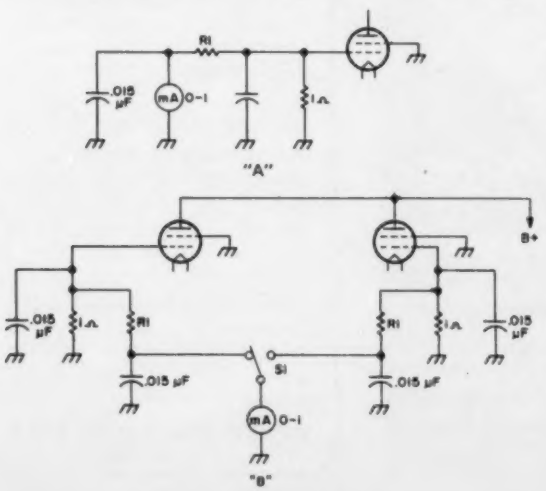
Furthermore, because the shield is not uniformly spaced over the wire, the capacitive distribution will be uneven.

Q. What is the difference between a direct probe and an isolation probe for a scope?

A. Just as the name implies, a direct probe is a test probe which is connected to a piece of shielded cable without series resistance or capacitance. The isolation probe can be either capacitive or resistive – or both – and serves to present a higher impedance, a lower capacitance or higher resistance (less load) to the circuit under test.

Q. What can be used in an emergency to check circuit continuity?

A. Use your receiver and two test leads – one connected to the receiver's antenna terminal and the other terminated directly to the antenna. You'll notice continuity – and varying degrees of such – by the resultant increase in receiver gain on the S-meter. Tune to a station that is fairly weak without the antenna connected.



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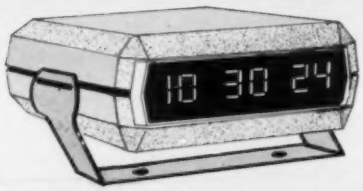
196-23 Jamaica Ave., Hollis, New York 11423

DIGITAL AUTO CLOCK



This elegant, handsome clock will look smart anywhere you put it — car, boat, mobile home, kitchen, bedroom, shop or den. High-impact ABS plastic case combines durability and beauty of design. The snap-on mounting bracket allows easy installation and removal.

The heart of this chronometer is a high frequency crystal oscillator which provides an accuracy of ± 1 minute per month even in changing temperature or electrical "noise" conditions. Easy to assemble kit with complete step-by-step instructions. Or, for those who would rather not, a ready-built and tested unit is also available.

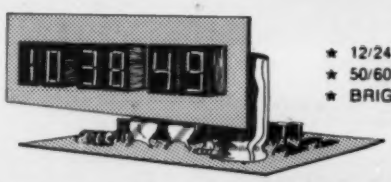
FEATURES INCLUDE:

12 or 24 hour time format — Displays time in hours, minutes and seconds on 6 large, .4" red LED displays – Operates on any 9-14 volt AC or DC power — Simple, non-polarized power input — Internal 9 V battery assures timekeeping (without display) when external power is removed — Special circuit eliminates false counting caused by voltage spikes — Recessed switches in case front for quick and easy time setting — Optional AC adapter available.

Complete kit — includes all components, etched and drilled epoxy PC boards, mounting bracket and assembly instructions. (less 9 V battery).

Kit #SI-204 **Assembled #SI-204W** **110-V AC Adapter**
$27.95 **$37.95** **$2.50**

6 DIGIT LED CLOCK KIT



★ 12/24 HOUR
★ 50/60HZ
★ BRIGHT LEDS

This kit uses the MM5314 clock chip and is available with a choice of display sizes. Features 12 or 24 hour time format, 50 or 60 Hz input, fast and slow time setting with a hold function for precise time syncronizing. Kit includes all components, etched and drilled epoxy boards and complete step-by-step assembly instructions. (Case and transformer not included).

Kit #SI-10 with .27" Red LED's	**$11.50**
Kit #SI-14 with .4" Red LED's	**$13.95**
Kit #SI-15 with .5" Red LED's	**$16.95**
Transformer to suit. (pc lug mount type)	$ 1.25
Transformer to suit. (molded with line cord)	$ 2.50

60 HZ CRYSTAL TIME BASE

This kit enables any AC powered clock to be operated on DC. Compact size — only 1" x 2". Power requirement: 5-15 VDC @ 3 mA. Kit includes all components, PC Board and easy to follow hookup instructions for interfacing with most all MOS clock chips.

Kit #SI-62 . . . $5.75 ($4.75 when purchased with any clock kit).

CLOCK CHIPS

MM5314 - 6-digit, 12/24 Hr, 50/60 Hz Multiplexed, 24-pin	$3.75
MM5316 - 4-digit, 12/24 Hr, 50/60 Hz, Alarm, Snz, Timer, 40-pin	$4.50
50252 - 6-digit, 12 Hr/60 Hz, 24 Hr/50 Hz, Alarm, Snz, Mpx., 28-pin	$4.95
CT7001 - 6-digit, Clock, calendar, Radio Timer, 12/24 Hr, 28-pin	$6.95
MK50381 - 4-digit direct drive LED, 12 Hr, 50 Hz, Radio Timer, 40-pin	$6.95

9-DIGIT DISPLAY

Ideal for a mini clock, calculator or stopwatch. .11" digit height.
Special – $0.99 ea. . . 3/$2.50

FM WIRELESS MIKE KIT

Kit SI-36 is a completely new design in FM wireless transmitters. Unique PC layout eliminates the need for wire-wound coils which other units use. Can be used with any dynamic type microphone to broadcast on the FM band. Output is typically 100 mW with a 9-volt battery, but can be increased to 1 Watt with 50 volts. Frequency range adjustable from 50 MHz to 150 MHz. Size: Only 1.8" x 1.8". Complete kit includes all components, PC Board and assembly instructions. (less battery and microphone).

Kit #SI-36 . . . . . $ 3.95

LED DISPLAYS

FND-359	.38"CC	$0.95
FND-503	.50"CC	$1.29
FND-803	.80"CC	$3.50
DL747	.60"CA	$2.25
XAN-664*	.60"CC red	$2.75
XAN-654*	.60"CC grn	$2.95

*Denotes no decimal point.

LED DRIVERS

Quad segment driver. . .$0.49
Hex digit driver $0.59

DISCRETE LED

Submini red	8/$1.00
Mini red	7/$1.00
Mini green	6/$1.00
Jumbo red	6/$1.00
Jumbo green	5/$1.00

DIODES

1N4148	switch	20/$1.00
1N4005	1A/400V	15/$1.00
1N4007	1A/1000V	10/$1.00

LINEAR IC's

308 Precision Op Amp	0.99
380 2 Watt Audio Amp	0.99
555 Timer	0.55
565 Phase Locked Loop	1.19
567 Tone Decoder	1.75
709 Op Amp	0.25
741 Op Amp	0.25

VOLTAGE REGULATORS

LM309K 5v, 1 amp, T0-3	1.10
7805 5v, 1 amp, T0-220	0.95
7812 12v, 1 amp, T0-220	0.95
7815 15v, 1 amp, T0-3	1.25
7824 24v, 1 amp, T0-3	1.25

MEMORY

2102-1 1K Static RAM	1.69
21L02B Low pwr. version	1.95

TRANSISTORS

2N2222 NPN	8/$1.00
2N3906 PNP House #	10/$1.00
2N4400 NPN	8/$1.00
2N4402 PNP	6/$1.00
2N3055 NPN	$0.79 ea.

ELECTROLYTIC CAPS.

2000 uF/15V	Axial	3/$1.00
1000 uF/25V	PC leads	4/$1.00
220 uF/25V	PC leads	5/$1.00
100 uF/25V	PC leads	6/$1.00
10 uF/25V	PC leads	8/$1.00

SWITCHES

SPDT Heavy duty Rocker . . . 6/$1.00
SPST Momentary Push Button . . . 3/$1.00

RESISTORS

100 assorted, mostly 5% & 10% some 20%. Full leads
100/$1.29 200/$2.10

SPEAKER / MIC.

40 ohms impedance – 1-1/8" dia.
Special – $0.79 ea. . . 3/$2.00

MJE 3055

90 Watt NPN Pwr. transistor mounted on heatsink plate.
Special – $0.69 . . . 3/$1.95

TERMS

Satisfaction guaranteed. We pay shipping in Continental USA. Others add 5%. Overseas add 10% (20% for Airmail). U.S. Funds only. Orders under $15.00 add 75¢ handling. Texas residents add 5% Sales Tax. Sorry — No COD or charge cards. Check or Money orders only.

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AMSAT

QSL BUREAU

AMSAT maintains a QSL bureau for confirming satellite QSOs. Any US or VE member or satellite user can maintain a few cases on file and will receive cards confirming contacts with other satellite users. Any AMSAT member can also send out cards confirming satellite contacts by means of the AMSAT bureau. There is no cost for cards destined to W, K or VE stations, and a flat rate of 6¢ a card to all other countries.

I recently had a chance to peruse the dead cards (cards at the bureau for which the recipient has no envelope on file). There are DX cards, rare states and special event stations cards. Some people nearly have enough cards for an OSCAR or Satellite 1000 award waiting for them at the bureau. These cards will have to be returned to the senders or destroyed in the near future. If you use the satellites but do not have a case on file at the AMSAT QSL Bureau, send at least one in today. If you are an AMSAT member, you can also send out cards at the same time. You may be pleasantly surprised as to what you will find in your first returned case. The address is: AMSAT QSL Bureau, Dennis Grinerod WA1EHF, Manager, 564 Stillman St., Bridgeport CT 06608.

TWO SATELLITES IN ORBIT

We have marked the fourth anniversary of the launch of AMSAT-OSCAR 6 and the second anniversary of the launch of AMSAT-OSCAR 7. It is important that the lifetimes of the spacecraft not be foreshortened by the use of excessive uplink power. The QRP days have shown that modest amounts of rf can put good signals into the spacecraft. Less than 10 Watts of radiated power is all that it takes to put a strong signal into A-O-7 Mode B, and less than 100 Watts will do the same for Mode A on both spacecraft, provided that there are few QRO operators. Please, do not use or encourage high power operation via the satellites. If you have trouble hearing yourself, don't increase your uplink power, but examine your receiver. If you CANNOT hear the beacon signals from AMSAT-OSCAR 6 on an overhead pass, you need to improve your receiving capabilities.

TWO SATELLITES TO COME

AMSAT is currently building two spacecraft. The Phase III spacecraft has a launch date in December, 1979. The European Space Agency (ESA) has agreed to provide a place on the second ARIANE launch vehicle flight. This will be the first non-US launch of an OSCAR spacecraft. AMSAT is also working on a Phase II spacecraft. This spacecraft is known as A-O-D, and is destined for launch in late 1977. It is a joint venture of AMSAT, Project OSCAR and JAMSAT. It marks the first time that Project OSCAR and AMSAT have cooperated on building flight hardware. A-O-D will contain two transponders: a 145/29 MHz unit built by AMSAT in Washington DC, similar to the one flown on AMSAT-OSCAR 6, and a 145/435 MHz transponder being built by the Japanese AMSAT Association. A prototype of this transponder has been tested on Mount Fuji in Japan with promising results. One unique aspect of that transponder is that it uses a power FET in the final.

The frequencies to be used by A-O-D are as follows:

UPLINK (MHz)
145.85-145.95, 145.9-145.95
DOWNLINK (MHz)
29.4-29.5, 435.1-435.15
BEACON (MHz)
29.4, 435.095

Note that the 145/435 transponder bandwidth may be slightly narrower than shown and incorporates passband inversion (cf. A-O-7 Mode B).

This satellite is primarily designed for the educational program to provide the capability for satellite demonstrations and communication through to 1980 and the launch of the first Phase III spacecraft.

SPONSOR A SOLAR CELL

Building two spacecraft is an expensive business. The cost of the solar cells alone is estimated to be in the tens of thousands of dollars. AMSAT just does not have that kind of money, so those funds have to be raised somehow. When a terrestrial FM repeater is put on the air, the users normally contribute towards the cost of establishing and maintaining the repeater in operation.

Spaceborne transponders are many times more expensive than terrestrial repeaters (A-O-7 cost us $60,000, an identical commercially built unit could have cost $2,000,000). AMSAT is in the middle of a "sponsor a solar cell" campaign. If you can contribute at least $10.00, help in administering the program or have any constructive ideas on the subject, contact Tom Clark WA3LND at AMSAT, or send in your tax deductible sponsoring donation. All solar cell sponsors will receive a certificate attesting to their status.

THINKING AHEAD

Almost every day a new call is heard through the downlink of AMSAT's OSCAR 6 and 7. When the Phase III spacecraft is in orbit, the situation will change drastically. No longer will we be limited to 5000 miles, for a whole hemisphere will then come into range. For the first years of operation, any station in the Northern Hemisphere will be able to communicate with any other in that hemisphere for up to 15 hours a day, as well as with Southern Hemisphere stations for part of the time. This communication facility will be there irrespective of the state of the sunspot cycle, solar flares and most other phenomena that upset conventional HF band communications.

Consider what that will mean in terms of QRM!

On a "typical" HF band such as forty meters, a number of QSOs can take place on one frequency at any time, because depending on the time of day, two stations located in, say, Europe can work each other without hearing two stations in North America also working each other on the same frequency. It would also be possible for more QSOs to take place on the frequency causing minimal QRM as long as those other stations are well separated or within the dead zone (skip effect). In fact, this is normal for forty meters.

Now consider two meters. 144.12 MHz is a typical SSB frequency. At any given time, many QSOs could take place on that frequency, without causing any QRM at all to each other, because of the geographical spacing between the stations in QSO and the line of sight properties of 2 meter propagation.

What would happen if the characteristics of forty meters were suddenly superimposed onto the two meter band? Instant QRM! Stations all over half a world would suddenly start hearing one another on the frequency. Local QSOs could take place, simply by covering up more distant stations on the same frequency. DX work would be possible only if no locals appeared on the frequency at either end. Now take away the dead zone, and let the band be open to everywhere at the same time. Everyone is now a "local," and can be heard anywhere else.

This is what may happen to part of two meters (and 70 cm) when the Phase III spacecraft is in its final orbit. It is up to us to plan ahead to try and control the QRM so that QSOs can take place.

A two meter FM repeater puts a station in contact with any other one within, say, 60 miles or so for up to 24 hours a day.

Oscar Orbits

Oscar 6 Orbital Information				Oscar 7 Orbital Information			
Orbit	Date (Feb)	Time (GMT)	Longitude of Eq. Crossing °W	Orbit	Date (Feb)	Time (GMT)	Longitude of Eq. Crossing °W
NA 19652 BTN	1	0101:52	74.5	10127 B	1	0108:20	69.3
19664 Q	2	0001:48	89.5	10139 BX	2	0007:40	54.2
N 19677	3	0056:44	73.3	10152 B	3	0101:58	67.7
NA 19689 BTN	4	0151:39	87.0	10164 A	4	0001:18	52.6
N 19702	5	0051:36	72.0	10177 B	5	0055:35	66.2
S 19715	6	0146:31	85.8	10190 A	6	0149:52	79.7
N 19727	7	0046:27	70.8	10202 BQ	7	0049:13	64.6
NA 19740 BTN	8	0141:23	84.5	10215 A	8	0143:30	78.2
19752 L	9	0041:19	69.5	10227 BL	9	0042:50	63.0
19765 L	10	0136:14	83.3	10240 BL	10	0137:08	76.6
19777 L	11	0036:10	68.3	10252 BL	11	0036:28	61.4
N 19790	12	0131:06	82.0	10265 A	12	0130:45	75.0
S 19802	13	0031:02	67.0	10277 B	13	0030:06	59.9
N 19815	14	0125:58	80.8	10290 A	14	0124:23	73.4
NA 19827 BTN	15	0025:54	65.8	10302 B	15	0023:43	58.3
19840 Q	16	0120:49	79.5	10315 BX	16	0118:00	71.9
N 19852	17	0020:45	64.5	10327 B	17	0017:21	56.7
NA 19865 BTN	18	0115:41	78.3	10340 A	18	0111:38	70.3
N 19877	19	0015:37	63.3	10352 B	19	0010:59	55.1
S 19890	20	0110:33	77.0	10365 A	20	0105:16	68.7
N 19902	21	0010:29	62.0	10377 BQ	21	0004:36	53.5
NA 19915 BTN	22	0105:24	75.8	10390 A	22	0058:53	67.1
NA 19927 BTN	23	0005:20	60.8	10403 BX	23	0153:10	80.7
N 19940	24	0100:16	74.5	10415 A	24	0052:31	65.8
NA 19952 BTN	25	0000:12	59.5	10428 B	25	0146:48	79.1
N 19965	26	0055:07	73.3	10440 A	26	0046:09	64.0
S 19978	27	0150:03	87.0	10453 B	27	0140:26	77.6
N 19990	28	0049:59	72.0	10465 A	28	0039:46	62.4

The listed data tells you the time and place OSCAR crosses the equator in an ascending orbit for the first time each day. To calculate successive orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the first crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world, it will descend over you. To find the equatorial descending longitude, subtract 166 degrees from the ascending longitude. To find the time it passes the north pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR when it is within 45 degrees of you. The easiest way to do this is to take a globe and draw a circle with a radius of 2480 miles (4000 kilometers) from the home QTH. If it passes right overhead, you should be able to hear it for about 24 minutes total. OSCAR will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15 degrees from you, add another minute; at 30 degrees, three minutes; at 45 degrees, ten minutes.

OSCAR 6: Input 145.85-145.95 MHz; Output 145.90-146.00 MHz; Output 29.40-29.50 MHz. 29.45-29.55 MHz; Telemetry beacon at 29.45 MHz. Mode B: Input 432.125-432.175 MHz; Output 145.925-145.975 MHz. OSCAR 7 Mode A: Input

Orbits designated "X" are closed to general use. "ED" are for educational use. "BTN" orbits contain news bulletins. "Q" orbits have a ten Watt erp limit. "L" indicates link orbit. "N" or "S" indicates that Oscar 6 is available *only* on northbound or southbound passes. Satellites are not available to users on "NA" days.

The transponders on AMSAT's OSCAR 6 and 7 increase that range to 5000 miles, but only for 20 minutes or so, three or four times a day. The Phase III spacecraft will put a whole hemisphere in range for up to 15 hours a day. This means that round-table QSOs between stations in Europe, the U.S.A. and Japan could become commonplace. This would introduce a whole new era in phone patches, traffic handling, emergency communications, and educational uses.

It is these latter uses that will be instrumental in getting a place aboard the launch vehicle for the spacecraft. It's going to take a lot of planning to ensure that we utilize the Phase III spacecraft in the best way. One way to do it would be to split the passband into modes, similar to the voluntary band plans in effect in IARU Region 1 on all amateur bands. Starting at one end of the passband, there is a CW section, then an SSB section, with an overlap area for mixed mode contacts. The top end of the SSB section and the bottom end of the CW section could be used for traffic and messages where allowed by the licensing authorities. Then follows a segment reserved for SSTV and RTTY. Another segment is reserved for educational uses, including an Emergency Calling Frequency. The last section is a small one reserved for the use of the AMSAT Command Stations as an intercom frequency. It may also be used for announcements, similar to those presently being made on AMSAT's OSCAR 6 and 7. The actual locations of the assignments and the amount of passband allocated to each must be made by us as users, because it is voluntary and can only be enforced if the users agree to do so. The development of any kind of band plan *should be started now*, because it's going to take two years to get everyone to agree.

Your comments are needed. Comment on the type of band plan (if any), the amount of spectrum allocated to each mode, and on anything else.

Repeater Update

The following repeaters have been licensed and have gone on the air since the publication of the last *73 Repeater Atlas*. Other areas of the country will be updated in future issues. Watch for publication of the new *73 Repeater Atlas* soon.

Connecticut

WR1AFR	New Canaan	447.70	
WR1AGC	Avon Mountain	224.78	
WR1AGD	Ansonia	146.985	
WR1AHA	Harwinton	147.27	
WR1AHP	West Haven	147.255	RTTY
WR1AHP	New Haven	147.855	
WR1AMU	Storrs	147.30	

Massachusetts

WR1AAA	Malden	29.52	29.685 IN
WR1ABK	Westwood	149.295	
WR1ABP	Billerica	147.12	
WR1ACO	Malden	449.40	
WR1AEO	Brookline	146.39	146.99 IN
WR1AFO	Belmont	448.10	
WR1AFP	Fitchburg	224.34	
WR1AGK	Yarmouth	147.645	
WR1AHL	Springfield	224.34	
WR1AHR	Chatham	147.375	
WR1AIT	Somerville	224.18	

Maine

WR1AES	Boothbay Harbor	146.79	
WR1AQW	Topsfield	146.67	

New Jersey

WR2ACQ	Atlantic City	146.745	
WR2ADK	Pleasantville	147.21	
WR2AEA	Punnemede	146.76	
WR2AGZ	West Orange	146.415	147.415 IN
WR2AHV	Newton	147.50	
WR2AHY	Frenchtown	146.85	
WR2AIN	Kearney	146.475	147.475 IN
WR2AIO	Middletown	146.50	147.50 IN
WR2AJC	Princeton	146.46	147.46 IN
WR2AJY	Willingboro	146.925	
WR2AKE	Manahawkin	146.835	
WR2AKJ	Cape May	146.61	
WR2ALW	Robbinsville	147.21	
WR2	Willingboro	224.86	
WR2	Atlantic City	147.00	

New York

WR2AAB	Yonkers	146.46	147.46 IN
WR2ACB	Stony Brook	448.825	
WR2AFV	Rochester	146.70	
WR2AHV	Newton	147.30	
WR2	Cooperstown	146.64	
WR2	Delmar	146.64	
WR2	Cuba	146.94	
WR2	Niagara Falls	147.36	
WR2	Syracuse	147.18	
WR2	Warren Cty Raceway	146.73	
WR2	Buffalo	53.05	52.05 IN (T 1407)

FCC

BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

In the Matter of

Waiver of Section 97.28(b)(1) of the Commission's Rules

ORDER
ADOPTED: NOVEMBER 23, 1976;
RELEASED: NOVEMBER 24, 1976

1. The Chief, Safety and Special Radio Services Bureau, acting under delegated authority, has under consideration the waiver of Section 97.28(b)(1) of the Commission's Rules in order to establish a procedure for processing requests for multiple Novice Class written examinations. Under the present rules, an applicant for a Novice Class license in the Amateur Radio Service must first pass a test in the use of Morse Code before making an application that a written test be sent to the applicant's volunteer examiner for administration. In situations where one examiner has been tutoring many applicants, problems have arisen in the time delay experienced in receiving the exams by mail and then administering them after the regularly scheduled sessions of instruction have ended. It is anticipated that large groups of students will be concluding their Novice courses in the next few months and that a method for expediting applications will be necessary.

2. A waiver of Section 97.28(b)(1) will allow an examiner with several applicants to apply for the written examinations prior to successful completion of the Code test. To implement this new procedure, the Commission will require the following:

(a) Examiners must administer the tests to at least five applicants.

(b) Requests for exams must be received no later than thirty days prior to the date of examination.

(c) Examiners must continue to meet the eligibility requirements of Section 97.28(b): They must be twenty-one years of age or older, holders of a General Class license or higher, and unrelated to any of the applicants.

(d) Requests must include the number of tests needed, the date the examinations are to be given, the name and address of the examiner and a photocopy of the examiner's license.

3. Examiners are reminded that they will be held accountable for returning all used and unopened examinations, and that they are expected to establish a method of control to insure the integrity of each examination. All requests for examinations should be mailed to: Federal Communications Commission, P.O. Box 1020, Gettysburg PA 17325.

4. Accordingly, the Commission, by the Chief, Safety and Special Radio Services Bureau, under authority delegated pursuant to Section 0.331 of the Commission's Rules, ORDERS that Section 97.28(b)(1) of the Rules is hereby WAIVED for the period beginning November 24, 1976 and ending June 30, 1977.

FEDERAL COMMUNICATIONS COMMISSION
Charles A. Higginbotham
Chief, Safety and Special Radio Services Bureau

Ham Help

Under date of September 11, 1976, I wrote your magazine to the effect that I was an over-aged citizen disenchanted with CB, wondering how I could get into amateur radio, how I could accumulate in a hurry the knowledge that licensed hams already have, and requesting information on the sources of used ham gear. For your convenience I enclosed a stamped return envelope.

You did not personally answer my letter. You *did* publish my letter in the Ham Help column of the very next issue of *73 Magazine* which went to press!

That is when all hell broke loose!

Within a two week span following publication, I received more than two dozen letters, one from as far away as Sioux Falls, South Dakota, providing genuine assistance of one form or another. During this same period, I received at least a dozen phone calls, one of which was from as far as fifty miles away, again offering the kind of assistance I had hoped for in my letter to you!

In all of my previous experience, I had never encountered such willingness to be of help, and all of it offered without any expectation of monetary return!

As a consequence of your publication of my plea, I did enroll in a Novice class course at UMPG (although it had already run too many sessions for me to catch up), found a volunteer of assistance toward Novice within 10 miles of my home, located

Continued on page 135

73 LIBRARY

NEW REPEATER ATLAS

Hundreds of new listings . . . listed by both location and frequency . . . dual listing, invaluable for your car . . . find those repeaters as you travel. This is the ONLY complete list of repeaters being published. Almost 3000 repeaters listed in this issue . . . repeaters from all over the entire world. only $1.95

VHF ANTENNA HANDBOOK

The NEW VHF Antenna Handbook details the theory, design and construction of hundreds of different VHF and UHF antennas . . .

A practical book written for the average amateur who takes joy in building, not full of complex formulas for the design engineer. Packed with fabulous antenna projects you can build. $4.95

73 VERTICAL, BEAM AND TRIANGLE ANTENNAS by Edward M. Noll W3FQJ

Describes 73 different antennas for amateurs. Each design is the result of the author's own experiments: each has actually been built and air-tested. Includes appendices covering the construction of noise bridges and antenna line tuners, as well as methods for measuring resonant frequency, velocity factor, and standing-wave ratios. 160 pages. $5.50

73 DIPOLE AND LONG-WIRE ANTENNAS by Edward M. Noll W3FQJ

This is the first collection of virtually every type of wire antenna used by amateurs. Includes dimensions, configurations, and detailed construction data for 73 different antenna types. Appendices describe the construction of noise bridges, line tuners, and data on measuring resonant frequency, velocity factor, and swr. 160 pages. $5.50

2M FM HANDBOOK

Contains almost every conceivable circuit that might be needed for use with a repeater. All circuits explained in detail. All aspects covered, from the operator to the antenna. $5.95

Practical Test Instruments You Can Build

37 simple test instruments you can make – covers VOMs, VTVMs, semiconductor testing units, dip meters, wattmeters, and just about anything else you might need around the test lab and ham shack. $4.95

IC OP-AMP COOKBOOK

by Walter G. Jung. Covers not only the basic theory of the IC op amp is great detail, but also includes over 250 practical circuit applications, liberally illustrated. 592 pages, 5½ x 8½, soft bound. $12.95

RF AND DIGITAL TEST EQUIPMENT YOU CAN BUILD

RF burst, function, square wave generators, variable length pulse generators – 100 kHz marker, i-f and rf sweep generators, audio osc, af/rf signal injector, 146 MHz synthesizer, digital readouts for counters, several counters, prescaler, microwavemeter, etc. 252 pages. $5.95.

WEATHER SATELLITE HANDBOOK

Simple equipment and methods for getting good pictures from the weather satellite. Antennas, receivers, monitors, facsimile you can build, tracking, automatic control (you don't even have to be home). Dr. Taggart WB8DQT $4.95.

SSTV HANDBOOK

This excellent book tells all about it, from its history and basics to the present state of the art techniques. Contains chapters on circuits, monitors, cameras, color SSTV, test equipment and much more.
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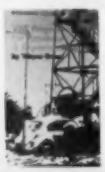

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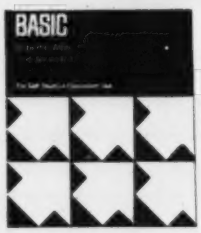

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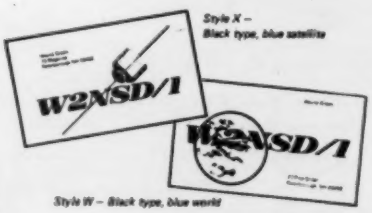

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5 WPM This is the beginning tape for people who do not know the code at all. It takes them through the 26 letters, 10 numbers and necessary punctuation, complete with practice every step of the way using the newest blitz teaching techniques. It is almost miraculous! In one hour many people — including kids of ten — are able to master the code. The ease of learning gives confidence to beginners who might otherwise drop out.

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6 WPM This is the practice tape for the Novice and Technician licenses. It is made up of one solid hour of code, sent at the official FCC standard (no other tape we've heard uses these standards, so many people flunk the code when they are suddenly — under pressure — faced with characters sent at 13 wpm and spaced for 5 wpm). This tape is not memorizable, unlike the zany 5 wpm tape, since the code groups are entirely random characters sent in groups of five. Practice this one during lunch, while in the car, anywhere and you'll be more than prepared for the easy FCC exam.

13 WPM Code groups again, at a brisk 13 per so you will be at ease when you sit down in front of the steely eyed government inspector and he starts sending you plain language at only 13 par. You need this extra margin to overcome the panic which is universal in the test situations. When you've spent your money and time to take the test you'll thank heavens you had this back breaking tape.

20 WPM Code is what gets you when you go for the Extra Class license. It is so embarrassing to panic out just because you didn't prepare yourself with this tape. Though this is only one word faster, the code groups are so difficult that you'll almost fall asleep copying the FCC stuff by comparison. Users report that they can't believe how easy 20 per really is with this fantastic one hour tape. No one who can copy these tapes can possibly fail the FCC test. Remove all fear of the code forever with these tapes.

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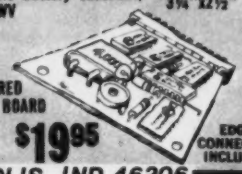

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Ham Help

from page 131

some used ham gear, and have developed some new acquaintances who are sincere in their desire to be of help!

How can you beat that?

You may be sure that if I'm smart enough to get my Novice ticket, I will also be smart enough to get me a subscription to *73*!

Please accept my sincere thanks for your assistance.

Charles A. Jurack
Bridgton ME

I am planning a tour to "GC" next summer. Would you please add my name and address to your Ham Help column, so I might get in touch with somebody there?

Heinz-Dieter Mahlfeldt DC5BT
Goethestr. 86
2850 Bremerhaven
West Germany

Would you please run the following in your Ham Help column, as I need to obtain these parts so I can get on the air. I received my license on 28 Oct 76 and desperately want to get on the air.

Needed: 60 kHz (tuned circuit and coil) belonging to a Hammarlund HQ-170 receiver (parts designations are: M42005-1, M42005-4). I ask that anyone having these parts or an HQ-170 that can be cannibalized please write me.

John J. Sealy WB3EPG
7 N. Summit Dr., Apt. 301
Gaithersburg MD 20760

I live on an annoyingly small city lot that will not accommodate dipoles for 160, 80, and 40. I want to put up an efficient all band Hertz antenna or random wire, and also a 25 foot vertical for low angle work.

I would like to hear from any hams who use outdoor remote-controlled transmatches to load their verticals and wire antennas. There is no information on remote switching or tuning in ham and antenna manuals anywhere, to my knowledge.

It might be a good idea to run an article on motorized, continuously tunable transmatches ("L" networks tune easily), or preset relay-operated transmatches. Other city dwellers besides myself might benefit.

James G. Coote WB6AAM
6525 Elder St.
Los Angeles CA 90042

Special Report

from page 15

channel spacing (e.g., 8 or 9 kHz) has also been addressed by the SWG. While Regions 1 and 3 have adopted plans to reduce channel separation as a means of increasing the number of channels, this scheme affects adjacent channel interference, the development of AM stereo, and poses serious conversion problems for the US which has developed its AM service largely around the use of directional antennas designed for use only on specific frequencies. Comments on this issue and the extension of the broadcast band to 1805 kHz are requested.

The International Broadcasting SWG indicated that additional spectrum was required, particularly at 3900-4000 kHz. We have not proposed any change to the band 3900-4000 kHz, which permits broadcasting in certain regions under specified conditions. Although the recent LF/MF conference rejects the use of single side band, we feel this technique should be examined and commented upon.

The International Broadcasting (SWG) requested retention of their present allocations of a total of 2150 kHz and additional worldwide allocations of more than 2000 kHz; this amount would double the current allocation and include approximately 20% of the spectrum available between 4 and 27.5 MHz.

The Commission currently licenses ten transmitters for operation in the high frequency bands allocated to broadcasting, approximately 5% of the total US broadcasting; the other 95% of US HF Broadcasting is conducted by the US Government through USIA and the Board for International Broadcasting. Presently, throughout the world, there are approximately 1500 transmitters on the air carrying about 22,000 daily frequency hours. Two or three international shortwave broadcasters operating on one frequency is a common occurrence. The US requirements for additional spectrum in the HF band are under consideration.

Citizens Radio

The Citizens Radio SWG requested an additional allocation of 1 MHz in the 26-28 MHz band, a 5 MHz allocation in the band 216-300 MHz with 220-225 MHz preferred, and a 10 MHz allocation between 470 and 947 MHz, preferably between 890 and 947 MHz. These are needed to meet the explosive growth of CB and to provide additional services such as channels for repeater operations, municipal service tie-ins, and weather information.

The SWG further requested that this service be redesignated as the "General Radio Service," and that this new service be recognized internationally by the inclusion of it and its associated spectrum in the ITU table of frequency allocations. The utilization of Citizens Band frequencies in the US is extensive by any standard, with the uses extending into nearly every area of personal and business communications. However, we are unable to endorse the principle of advancing an international allocation for a specific service, such as the "General Radio Service," particularly when the need for such a service has not been advanced on a large scale.

There is already a provision for the Mobile service between 27.5 and 28 MHz in the International Table, so no change is required, recognizing, however, that in the US the band 27.54-28 MHz is subject to exclusive government use. We are proposing that the band 220-225 MHz be allocated for shared use by the Mobile Service with the Amateur, Amateur Satellite and Radiolocation Services. Part of this band could be allocated domestically to the Citizens Radio Service, if it is eventually decided that this allocation would be in the public interest. As our table shows, we also propose to meet the requirements of the Mobile services by providing access to the band 890-947 MHz; use of these frequencies by the Citizens Radio Service could result from domestic rulemaking.

Further, an effort to establish CB as the "General Radio Service" could well work against the expansion of spectrum desired by the Citizens Band SWG since future domestic allocation actions may well provide for expanded spectrum. Thus, we are proposing to continue the present international allocation at 26100-27500 kHz for Fixed and Mobile (except Aeronautical Mobile), which is used domestically in part by the Citizens Radio Service. While the actual desires of the SWG have not been fulfilled, we feel that our proposal will prove to be the most beneficial one for the needs of the service in the long range future.

Conclusion

As we have previously indicated in this proceeding, all participants should keep in mind the importance of the 1979 WARC results. Based upon past experience, decisions reached at this conference can be expected to provide the basis for international radio regulation policy for most of the remainder of this century. It is of the utmost importance to develop US proposals which effectively promote that combination of telecommunication uses which offers the maximum social and economic contribution to the national welfare and which also contain the flexibility necessary to accommodate important new applications of this dynamic technology as well as the unique requirements of our international partners in the ITU.

LETTERS

from page 126

wrote to Washington DC to Advertising, Credit, and Fraud, Margery Smith, Acting Director, Bureau of Consumer Protection, Federal Trade Commission, Washington DC 20850. Yesterday the mailman had a letter from Trigger — yes, just a *check*. *But Margery Smith did it*. Now I am going to *"burn"* a Blue Electronics Book for good. Took a FCC radio test yesterday and now I can move forward again after 2 years of waiting for parts.

My 73 to the publisher and thanks.

Frank J. Jelinek, Jr.
Linwood NE

BALONEY!

The card is because I must take immediate issue with the Holiday issue, page 8, second letter, as follows:

Baloney, Wayne, it IS that good and gettin' always better!

That's not my ego — I began writing for you because *73* IS the best. If I qualify for you, I stand well judged, and then I strive to do better each time, too.

Feel free to put this in "Letters." You have earned the praise — in spades — and in spite of IRS, big (phoney) business, and the stigma of CQ past. Hi!

Dave Brown W9CGI
Noblesville IN

I/O DOWN UNDER

I saw you needed articles for the I/O section of *73*, so I'm enclosing one. I could not think of anything more useful to a microprocessor than interrupts (boy ... am I getting sick of typing that). I hope it will be of some use. If you want an article on programs (not programming, you seem to have enough of them), it's coming up next. Around here a small group of us are getting micros built; we have access to a resident cross-assembler to the Burroughs Computer for the M6800 with Mikbug — very useful. We also have a number of minis at university (at present I am a student at Auckland University doing computer studies and electronics) with interactive BASIC.

I am now working on an ALGOL interpreter for an M6800 (ALGOL is a high level scientific and general purpose language; it stands for ALGOrithmic Language, and has lots of nice features not found in FORTRAN). I'll let you know about that later. Probably some time in 1978-9, the way things move around here.

I enjoy reading your I/O section; keep up the good work.

Robert Leyland ZL1TRM
Auckland, New Zealand

HEURISTICS

The article "What Computers Can And Can't Do" in your Holiday issue was an interesting one, and has moved me to make two comments. The first is an answer to the question of unfair competition raised at the end of the article. The simple answer to this is that any station which receives any assistance during the contest automatically falls into the multi-operator category. Your readers must ask themselves if their stations, computerized or not, can compete with the likes of W3AU or W7RM. The second is a slightly more philosophical one, and open to debate. Since there is no well defined technique or algorithm for contest operating, the computer program must involve heuristics and, as a result, the personality and prejudices of the programmer will be built into the program. In short, the computerized contest station, although faster than its human owner/programmer, will probably not be a much better contest operator.

Robert A. Hyman K3OCN
Silver Spring MD

SCHULTZ COLLAPSES

Even though I may be considered one of your Associate Editors, I am going to sue you!! The bookshelf I had hung on the wall collapsed after I placed the 11/76 issue of *73* on it.

John Schultz W4FA
FPO New York

QUICK SERVICE

As the editor of *73*, I feel that you must be informed of the extremely fast service I received from one of your advertisers. The company I am referring to is Kemit Electronics, Sunnyvale CA.

They had advertised the G.I. chip AY38500 TV game chip for $29.95, so I sent them a check one week ago today. Lo and behold, today in my mail was a package from them.

I feel that such service should not go by without your knowing about it. I feel that these people should be put on your list of good advertisers.

Raymond J. Keefe
Montclair NJ

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The six words per minute practice cassette will make sure that you will almost fall asleep during the FCC test. This one hour cassette (which will play in any cassette recorder) has only coded groups of letters so it is impossible to memorize, unlike the beginning cassette which has words and phrases which will have you laughing and make everyone think you are crazy . . . unless they can read the code too.

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Briefs

from page 118

"Citizens Amateur Radio Service"; RM-2770, to legalize the use of any emission mode on any amateur frequency; RM-2771, to permit the use of ASCII on the ham bands; RM-2774, which would set up temporary licensing; RM-2775, to expand the operating privileges of Novices and Technicians; RM-2776, to create a new Special Radio Service on 11 meters; and RM-2780, aimed at revamping logging requirements for repeaters.

AMSAT is looking for money and volunteers in order to continue the amateur satellite program. A spokesman at their Washington office told *73* that the ten dollar annual dues of the approximately 3000 members is not nearly enough to keep the program going.

Two satellites are currently awaiting funds to finish their construction. The AOD satellite, which will probably become OSCAR 8, will feature 2 meter to 432 MHz and 10 meter transponders, as well as microprocessor control. The 144-432 transponder was built by the Japanese AMSAT group and the structure by a group of California members. Only the 2 to 10 meter transponder needs to be finished. It's being built at AMSAT Washington, with a projected launch date of September, 1977. An AMSAT spokesman said that if OSCAR 6 is still in operation at the time of the launch of OSCAR 8, OSCAR 6 will be put on "furlough" and will probably be used for educational purposes only. OSCAR 6 had an expected life of one year when it was launched in 1972 and is still going strong.

The AMSAT Phase III satellite has a projected launch date sometime in 1979. Its higher orbit would make contacts possible over a 15 thousand mile range, rather than the current 5000 mile limit.

Because of the new equipment in both satellites, higher power solar cells will be needed. AMSAT is suggesting that contributors send ten dollars to buy a single cell (or more if possible). Although how to acknowledge the contribution has not been decided, it's expected the contributor would receive a certificate of some kind.

AMSAT is also attempting to put together a group of volunteers to approach foundations and corporations for larger contributions, since they doubt individual contributions will be enough to keep the program going.

Volunteers, ideas, and contributions are needed to keep the amateur satellite program operational over the next few years. Contact AMSAT, Box 27, Washington DC. The phone number is 202-488-8649.

Harrisburg hams have four repeaters on the air. Central Pennsylvania Repeater Association has just added a 220 MHz machine to a 450 MHz machine, a two meter teletype machine, and the well-known 16/76 repeater. The teletype machine is on 147.975/.375 MHz. Services worth hearing from the RTTY repeater at Harrisburg include ARRL bulletins every day, detailed radio propagation reports from NBS and ARRL, National Weather Service condition reports and forecasts for the East Coast and the world daily, plus the Yellow Sheet. (Yellow Sheet is a daily listing of all amateur gear for sale to amateurs in their area.) *Newsletter* of the Nittany Amateur Radio Club, State College PA.

The FCC has shut down its Canadaigua Monitoring Station, replacing it with a Limited Enforcement Office (LEO). HF monitoring and related direction finding will be terminated, with inspections, investigations, and VHF/UHF monitoring throughout NY and CT taking their place under a much reduced staff arrangement. *RaRa Rag,* Bulletin of the Rochester Amateur Radio Association, NY.

An Indianapolis IN federal court has convicted a CBer on six of nine obscenity counts. He was charged with use of profane and indecent language on CB. The *Indianapolis Star* called the case a landmark decision, after a two week trial. Thanks to *The Radiop's Log,* Bulletin of the Westpark Radiops, Cleveland OH.

Using an FCC computer, Texas amateurs recently caught a pair of bootleggers. FCC officials caught up with them within two hours, and federal charges followed.

It's called "Amigos de las Americas" . . . a social service organization devoted to helping the people of South America. The Amigos have conducted immunization, dental, and ophthalmological programs for some twelve years, using amateur radio for communications with their stateside headquarters. If you're looking for something to do this summer, and can pay your own transportation (about $700 round trip) and expenses, contact the Amigos representatives in Houston TX at 713-481-2502 or 713-526-2771. Those who apply should hold Technician class or better, and be prepared to keep daily schedules with Houston plus inter-

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staff communications, using either Amigos equipment or their own. The hams will be free to work DX or sightsee during off-hours. Stateside monitors are also needed 24 hours daily on 15, 20, and 40 meters. Countries participating during summer '77 include: Guatemala, Honduras, Nicaragua, Costa Rica, Ecuador, Bolivia, Paraguay, and Dominican Republic.

W1AW should have an improved signal soon. Construction is due to start on a 120' tower with stacked 4 element yagis for twenty and a 3 element yagi for forty. They look for a 10 dB improvement on forty and a bit less on twenty. *West Coast DX Bulletin.*

73 Publisher Wayne Green W2NSD is appearing weeknights on Boston's WGBH-TV. Wayne is a regular on Club 44, a show about leisure time activities. Subjects Wayne will cover range from ham radio (of course) to horseback riding and sports car rallying, along with microprocessors, CB, and more. That's Monday through Friday on channel 44 in Boston at 7:30 pm local time.

Edgecomb, Inc. of Torrance CA says it will produce the first microprocessor controlled 2m synthesized radio by spring. Company spokesman Ed Jay K6LOM (Signal 1-Multi 5000) says the rig will measure 2½ x 5½ inches, with 25 Watts output, programmable PL, scanner for priority channels, LEDs for frequency readout and decoding of repeater IDs, all for an expected list price of less than $500. According to Jay, the Edgecomb uses a 2901 chip (four bit slice) and will be available sometime this spring.

73 Advertising Director Bill Edwards WB6BED is expected back in his Peterborough office early in the new year, after suffering a mild heart attack. Bill recuperated at home, working part time out of his newly built ham shack. WB6BED can be expected to pack quite a signal from his Hillsborough diggings, especially on 40 and 20 meters.

Universal Subaudible Access Tone concept gains acceptance as the Chicago FM Club endorses the principle. This was first suggested on a broad scale by the Ohio Area Repeater Council, it seems, when the former president (Bill Mengel WA8PIA) of OARC placed the proposal before that body while in session at Delaware OH a couple of years ago. Subsequently, it was the subject of discussion at an FM forum during the Dayton Hamvention and has since been receiving attention in many areas. Briefly, the proposal advocates that guarded repeaters using subaudible tone for access (that are still "open" repeaters) provide a second tone access of 100.0 Hertz for use by transients running mobile and/or hand-held units. For example, Cincinnati repeaters using tone guard of 123.0 Hz would also install a decoder on 100.0 for travelers going through to access the system. It will, of course, require cooperation from those few systems now using 100.0 Hertz tone access to adopt a different tone as primary. Like all new concepts, it will be subjected to considerable discussion, but with the almost uncontrolled growth of repeaters, tone access is becoming an issue of major concern to repeater operators in populous areas. So, as tone access grows, the desire for a universal tone access for transients gains proponents. Lake Erie ARA *Newsletter*, Lakewood OH.

The FCC has made official a long held, but practically secret, policy on Novice license exam procedures. Under an order in later November '76, volunteer examiners can request up to five tests without first sending proof of an applicant's code proficiency. The FCC is apparently experimenting with the new procedure in the face of rapidly increasing Novice applications, because the rule will expire June 30, 1977. Address your requests for exams to FCC, PO Box 1020, Gettysburg PA 17325. FCC officials had informed *73* of the procedure, but requested we not publish news of it, fearing mass confusion would result in Gettysburg. The official notice arrived a week later.

2 METER CRYSTALS

FREQUENCIES IN STOCK

146.01T
6.61R
6.04T
6.64R
6.07T
6.67R
6.10T
6.70R
6.115T
6.715R
6.13T
6.73R
6.145T
6.745R
6.616T
6.76R
6.175T
6.775R
6.19T
6.79R
6.22T
6.82R
6.25T
6.85R
6.28T
6.88R
6.31T
6.91R
6.34T
6.94R
6.37T
6.97R
6.40T
6.46T
6.46R
6.52T
6.52R
6.55T
6.55R
6.58T
6.58R
6.94T
7.60T
7.00R
7.63T
7.03R
7.66T
7.06R
7.69T
7.09R
7.72T
7.12R
7.75T
7.15R
7.78T
7.18R
7.81T
7.21R
7.84T
7.24R
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7.90T
7.30R
7.93T
7.33R
7.96T
7.36R
7.99T
7.39R

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Drake TR-33 rec only
Drake TR-72
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Heathkit HW-202
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Ken/Wilson
Lafayette HA-146
Midland 13-505
Regency HR-2, A
Regency HR-212
Regency HR-2B
Regency HR-312
Regency HR-2MS
S.B.E.
Sonar 1802-3-4, 3601
Standard 146/826
Standard Horizon
Swan FM 2X
Tempo FMH
Trio/Kenwood TR2200
Trio/Kenwood TR7200

Note: If you do not know type of radio, or if your radio is not listed, give fundamental frequency, formula and loading capacitance.

CRYSTALS FOR THE IC-230 SPLITS IN STOCK: 13.861111 MHz; 13.884444 MHz; 13.917778 MHz; HEATHKIT HW2021 600 KHz. OFFSET 11.3 MHz; $6.50 ea.

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MODEL GG-144A — Deluxe, Two-Meter Colinear for Repeater or any fixed station operation. 6 db. gain over a ½ wave dipole. Maximum radiation at the horizon! Shunt fed with D.C. grounding. Radiator: ¼ wave lower section, ⅛ wave phasing, ⅝ wave upper section. Height: 117". SWR at resonance: 1.2:1 or better. Power rating: 1,000 Watts FM. Wind survival: 100 MPH. Installs on vertical pipe up to 1¼" O.D. 50-239 coax connector $52.95

STANDARD GAIN MOBILES
Two Meters
- 5/8 wavelength — 3.4 db gain over 1/4 wave mobile
- Frequency coverage—143 to 149 MHz
- Power rating—50 watts FM

MODEL BBLT-144 47" antenna complete with easy to install, no holes to drill, trunk lip mount, impact spring and 17' MIL SPEC RG-58-U and PL-259. Antenna removable from mount. $29.75

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MODEL THF Field trimmable radiator permits quarter wave operation on any frequency from 140 to 500 MHz. Cutting chart included. Complete with trunk lip mount, 17' RG-58-U and PL-259. $15.95

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Two Meters
- 5.2 db gain over 1/4 wave mobile antenna
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MODEL CG-144 Same characteristics as CGT-144 supplied with ⅜-24 base to fit all mobile ball mounts — Length is 61". Mount and cable not included. $26.75

HUSTLER "BUCK-BUSTER"
MODEL BF-2 51" two meter, 5/8 wavelength, 3.4 db gain over 1/4 wave mobile. Designed with ⅜-24 base to fit your mount or a wide selection of Hustler mobile mounts. (Mount or cable not included) $12.75

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For medium length, light weight antennas with ⅜ — 24 base.

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MODEL GCM-1 Rain gutter mount fits all shapes, angles even those trim line gutters. Includes 180° swivel ball. $7.50

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UNT-1 VHF/UHF ANTENNA—ROOF MOUNT
MODEL UNT-1 Field trimmable radiator for 1/4 wave operation on any frequency from 140 to 500 MHz. Cutting chart included. Mounts on any flat surface, roof, deck, fender in ⅜" hole. Includes 15' RG-58-U $10.15

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New Products

from page 20

condition in a matter of a few seconds. I just pop the magnetic mounts in the trunk.

One unique antenna in the line merits mention. The PO-150 is a 144-174 MHz 5/8 wave that is designed for use *without* a ground plane. It fits a standard PL-259 socket and works wonders on an HT as a replacement for the rubber duckie. These are useful for non-metallic vehicles such as boats, recreation vehicles, and Corvettes. A conversion kit can be ordered to adapt it to base use by the addition of radials.

The 50 and 144 MHz models handle 200 Watts of power, while the 440 MHz model handles 150 Watts. Base coils are coated with epoxy for full weatherproofing. These antennas are made for full-time use and should last longer than the car. All are covered by an unconditional six month guarantee.

Larsen says that you can hear the difference with their antennas. I tend to agree. Their high quality products are unique and dependable. The Larsen should be the last mobile antenna you'll ever have to buy.

Depending upon the mount and whip, Larsen antennas sell over a large range of prices. For example, a quarter wave permanent mount sells for $8.50, while a 5/8 wave with a magnetic mount retails for $38.55. *Larsen Electronics Inc., 11611 NE 50th Ave., PO Box 1686, Vancouver WA 98663.*

Stan Miastkowski WA1UMV
Associate Editor

TURNER HL6 MICROPHONE

Iowa-Turner Division of Conrac Corporation announces the availability of the Amateur HL6 microphone. This microphone has been designed specifically for the radio amateur who wants superior performance from a cardioid microphone, especially when vox is employed.

The Amateur HL6 has the capability of high or low impedance by selection on a slide switch inside the microphone. This fact, plus universal six wire switching, allows the Amateur HL6 to be easily installed with virtually all models of transceivers.

The Amateur HL6 has a flat frequency response from 50 to 13,000 Hz, which allows maximum speech intelligibility with a reduction of local noise interference. *Turner Division, Conrac Corporation, 716 Oakland Road NE, Cedar Rapids IA 52402.*

EICO IC SWEEP/FUNCTION GENERATOR

EICO, long a pioneer in the field of electronic test equipment, has introduced its new Model 390 Sweep/Function Generator.

In announcing the Model 390, Harry R. Ashley, President of EICO, stated, "It has long been EICO's policy to provide the professional technician and the home hobbyist with reliable test equipment at a moderate cost. By using the latest IC technology, we were able to develop a new breed of instrument which will rapidly overtake in popularity the traditional audio signal generator. This new .2 Hz to 200 kHz instrument is the practical answer to many of the signal source needs of design labs, schools, audio repair shops and hobbyists."

The Model 390 generates discrete sine, square, and triangle waveforms over the very broad frequency range of .2 Hz to 200 kHz, more than enough for the most exacting work. And, what's more, at the flick of a switch, you can have a choice of either linear or logarithmic sweep with a choice of slow, medium, or fast rates.

With its 50 Ohm output impedance and complete attenuation controls, the Model 390 can handle everything from checking the response of an audio amplifier to driving digital circuits, and with its low frequency triangle output, even driving servo systems! *EICO Electronic Instrument Incorporated, 283 Malta Street, Brooklyn NY 11207.*

GOLD LINE TERMINAL STUD KIT

A new Terminal Stud Kit for two way communications has been introduced by Gold Line Connector.

A Gold Line spokesman says the new kit (the #1105) was designed for batteries with side mounted terminals and that it provides the necessary connecting hardware for those direct-to-battery applications where standard battery studs do not. The 1105 lets you hook up communications equipment, tape players or automobile tune-up instruments easily. *Gold Line Connector, PO Box 893, East Norwalk CT 06855.*

SWITCHCRAFT ACQUIRED BY RAYTHEON

Plans for the acquisition of Switchcraft, Inc. by the Raytheon Company, Lexington MA, have been completed, according to a recent announcement by the two companies.

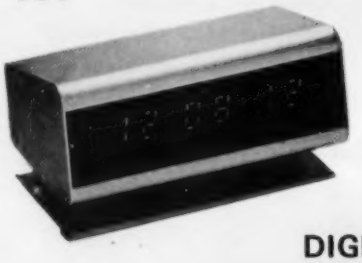
Upon completion of the acquisition early in 1977, Switchcraft will become a wholly owned subsidiary of Raytheon. Wilfred L. Larson, president of Switchcraft, who founded the company with Fred and William Dumke in 1946, will continue as president.

Larson said that "Switchcraft will maintain its program of marketing its products to electronic distributors and manufacturers through the independent sales representatives who have contributed to our company's success over the years.

"The new association with Raytheon is a big step forward for Switchcraft. It brings us the opportunity and means to expand our manufacturing facilities, which has become necessary to meet growing customer demands for our products. Also, we foresee the introduction of a number of new products to fulfill new customer needs." *Switchcraft, 5555 North Elston Ave., Chicago IL 60630.*

NEW-NEW-NEW

DC-5



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Mobile Version, .01% accuracy, 12 V dc $25.95
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LARGE .4" DIGITS

DC-4 includes all parts and switches, does not include PC board, case or transformer. DC-4 will not fit in case as shown above. Case size required, 3" x 5" x 4".

PC Board, drilled and etched, 3" x 4" $2.95
Transformer, line cord type, 12 V ac 1.98
Transformer, lug mount type, 12 V ac 1.49

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1000V, 2.5A **DIODE**	5/$1.00

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14 PIN	.25	50/10.00
16 PIN	.30	50/12.50
24 PIN	.50	10/ 4.50
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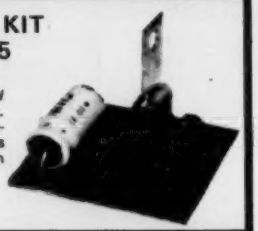

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- 7447 LED driver
- LED readout
- Current limit resistors

Complete with instruction and details on how to build an easy, low cost freq. counter.

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556	.85	74143	3.50
7490A	.59	7805	.99
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1N4005	600v	1A	.08
1N4007	1000v	1A	.15
1N4148	75v	10mA	.03
1N753A	6.2v	z	.25
1N758A	10v	z	.25
1N759A	12v	z	.25
1N4733	5.1v	z	.25
1N5243	13v	z	.25
1N5244B	14v	z	.25
1N5245B	15v	z	.25

SOCKETS/BRIDGES

8-pin	pcb	.25	ww	.45
14-pin	pcb	.25	ww	.40
16-pin	pcb	.25	ww	.40
18-pin	pcb	.25	ww	.75
22-pin	pcb	.45	ww	.75
24-pin	pcb	.35	ww	1.25
28-pin	pcb	.35	ww	1.45
40-pin	pcb	.50	ww	1.95

Molex pins .01 To-3 Sockets .25

2 Amp Bridge 100-prv 1.20

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2N2222	NPN			.10
2N2907	PNP			.15
2N3740	PNP	1A	60v	.25
2N3906	PNP			.10
2N3055	NPN	15A	60v	.50

LED Green, Red, Clear .15

D.L. 747 7 seg 5/8" high 1.95

XAN72 7 seg com-anode 1.50

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4002	.25
4004	4.95
4006	1.20
4007	.40
4008	1.20
4009	.25
4010	.45
4011	.20
4012	.25
4013	.40
4014	1.10
4015	.95
4016	.35
4017	1.10
4018	1.10
4019	.70
4020	.85
4021	1.35
4022	1.15
4023	.25
4024	.95
4025	.35
4026	1.95
4027	.50
4028	.95
4030	.45
4033	1.95
4034	2.45
4035	1.25
4040	1.35
4042	.95
4043	1.25
4044	.95
4046	1.50
4049	.80
4050	.70
4066	1.35
4069	.40
4071	.35
4082	.45

— T T L —

7400	.15
7401	.15
7402	.20
7403	.25
7404	.15
7405	.25
7406	.45
7407	.55
7408	.25
7409	.15
7410	.15
7411	.25
7412	.30
7413	.65
7414	1.10
7416	.25
7417	.50
7420	.15
7426	.40
7427	.45
7430	.15
7432	.45
7437	.45
7438	.35
7440	.25
7441	1.15
7442	.65
7443	.95
7444	.95
7445	.95
7446	.95
7447	.95
7448	1.20
7450	.25
7451	.25
7453	.25
7454	.25
7460	.40
7470	.45
7472	.45
7473	.35
7474	.40
7475	.45
7476	.20
7480	.65
7483	1.00
7485	1.05
7486	.40
7489	2.50
7490	.40
7491	1.15
7492	.95
7493	.45
7494	1.25
7495	.85
7496	.95
74100	1.85
74107	.45
74121	.40
74122	.55
74123	.55
74125	.45
74132	1.35
74141	1.30
74150	1.00
74151	.95
74153	.95
74154	.75
74156	1.15
74157	.75
74161	1.25
74163	1.25
74164	.95
74165	1.50
74166	1.35
74175	.95
74176	1.25
74180	.85
74181	3.25
74182	.95
74190	1.75
74192	1.65
74193	.85
74194	1.45
74195	.95
74196	1.50
74197	1.25
74198	2.35
74367	.85
75108A	.35
75110	.35
75491	.50
75492	.50
74H00	.25
74H01	.25
74H04	.25
74H05	.25
74H15	.30
74H20	.30
74H22	.40
74H30	.25
74H40	.25
74H52	.15
74H53J	.25
74H55	.25
74H72	.55
74H101	.75
74H103	.75
74H106	.95
74L00	.35
74L02	.35
74L03	.30
74L10	.35
74L30	.45
74L47	1.95
74L75	.55
74S00	.55
74S02	.55
74S03	.50
74S10	.45
74S11	.45
74S20	.50
74S40	.30
74S51	.45
74S64	.30
74S74	.50
74S112	1.50
74S133	.45
74S140	.75
74S151A	.45
74S153	.45
74S158	.45
74S194	1.50
74S257 (8123)	.25
74LS00	.45
74LS01	.45
74LS02	.45
74LS04	.55
74LS08	.45
74LS09	.45
74LS10	.45
74LS11	.45
74LS20	.50
74LS21	.25
74LS22	.25
74LS32	.55
74LS37	.40
74LS40	.55
74LS42	1.75
74LS52	1.45
74LS74	.95
74LS90	1.30
74LS93	1.00
74LS107	.95
74LS153	1.20
74LS157	.85
74LS164	1.90
74LS368	.70

9000 SERIES

9301	1.00
9309	.45
9602	1.50

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74S188 (8223)	3.00
8080	26.50
MM1702A	10.50
MM5314	3.50
MM5316	3.95
2102-1	1.75
2102-L1	1.95
TR 1602A	6.95

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MCT2	.95
8038	3.95
LM201AH	.75
LM301AH	.25
LM308AH	1.00
LM309H	.65
LM309K	.90
LM310	1.15
LM311	1.35
LM320K5	1.65
LM320K12	1.65
LM320T12	1.65
LM320T15	1.65
LM339	1.65
7805(340T-5)	1.00
LM340T-12	1.25
LM340T-15	1.25
LM340T-18	1.65
LM340T-24	1.25
LM340K-12	2.15
LM340K-15	1.65
LM340K-18	1.65
LM340K-24	1.25
LM373	1.95
LM380	.95
LM709	.30
LM711	.45
LM723	.45
LM725	1.95
LM739	1.50
LM741 8-14	.25
LM747	1.10
LM1307	1.25
LM1458	.95
LM3900	.65
LM75451	.65
NE555	.50
NE556	1.10
NE565	.95
NE566	1.75
NE567	1.35
SN72720	.35
SN72820	.35

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MC14011	Quad	2 input	Nand	.13
MC14012	Dual	4 input	Nand	.13
MC14023	Triple	3 input	Nand	.13
MC14025	Triple	3 input	Nor	.13
MC14027	Dual	J-K	Flip Flop	.28
MC14013	Dual	'D'	Flip Flop	.24

UNTESTED DIODES
A good assortment of 1 amp rectifiers. Good Yield. 50 for $ .60 - 100 for $ .95.

BATTERY CLIP
Standard 9V battery clip - 15 for $1.00.

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Telephone relay automatically starts and stops tape recorder. No batteries required. Kit complete with drilled PC Board. PARTS AND CASE - SATISFACTION GUARANTEED
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By National Electronics
12 DIGIT DISPLAY .4" character
Neon Orange in color
Specs Included **Only $ .79**
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LM340-6	LM340-15
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2N4400	6 / $1.00
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180Ω 1/4		20KΩ 1/4	
330Ω 1/4		22KΩ 1/4	
330Ω 1/8		27KΩ 1/4	
470Ω 1/4		33KΩ 1/4	
680Ω 1/4		39KΩ 1/2	
1K 1/4		43KΩ 1/4	
1.2KΩ 1/4		47KΩ 1/4	
2.2KΩ 1/4		56KΩ 1/4	
3.3KΩ 1/4		82KΩ 1/4	
3.9KΩ 1/4		100KΩ 1/4	
4.7KΩ 1/4		150KΩ 1/4	
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All resistors are PC Lead but are not pull offs
5% - 100 min. order Each value
No Mix - 99¢ 100

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PROTECTED DUAL GATE N-CHANNEL FET FOR LOW NOISE, VHF PREAMP APPLICATIONS - **Only $ .80**

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1 amp	50V	$ .89
10 amp	50V	1.29
25 amp	50V	1.49

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½ pound **$1.50**
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74LS00	.25	74LS74	.49
74LS02	.25	74LS90	.85
74LS04	.30	74LS132	.90
74LS08	.25	74LS138	.89
74LS10	.25	74LS139	.89
74LS11	.32	74LS155	.90
74LS20	.31	74LS157	1.00
74LS21	.33	74LS162	1.39
74LS22	.33	74LS163	1.39
74LS27	.30	74LS175	1.09
74LS30	.31	74LS193	1.09
74LS32	.33	74LS258	1.09
74LS37	.40	74LS367	.70
74LS38	.35	74LS368	.70

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Originally used in desk top calculators. Perfect for LED and other type of readouts. With peel-off protective coating. AMBER in color 5-5/8 x 1-3/8. 6/$1.00.

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LARGER .40 IN.
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7403	.19	7432	.34	7473	.25	74141	.75
74L04	.29	7437	.39	7474	.39	74145	$1.
7404	.19	7438	.39	7475	.59	74154	$1.
7406	.29	7440	.19	7480	.49	74161	.95
7408	.19	7442	.65	7485	.95	74163	$1.10
7409	.19	7443	.65	7490	.75	74164	$1.10
7410	.19	7444	.69	7491	.75	74174	.95
7411	.29	7446	.89	7492	.75	74175	$1.80
7413	.50	7447	.85	7493	.70	74180	.80
7420	.19	7450	.24	7494	.95	74191	$1.25
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CD4015	.75	CD4042	.59	CD4507	.40
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CD4019	.39	CD4050	.35	CD4520	.85
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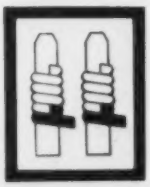
For AWG 30, .025" (0,63mm) sq. post, "MODIFIED" wrap, positive indexing, anti-overwrapping device



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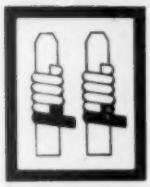

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- Iambic circuit for squeeze keying.
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- Battery operated with provision for external power.
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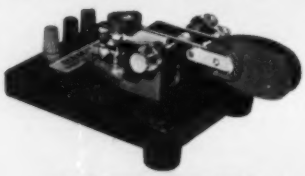

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- Dual lever squeeze paddle.
- Use with HK-5 or any electronic keyer.
- Heavy base with non-slip rubber feet.
- Paddles reversible for wide or close finger spacing.

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- Deluxe straight key.
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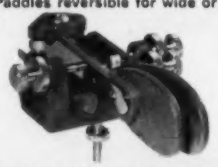

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- Same as HK-1, less base for those who wish to incorporate in their own Keyer.

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- Combination HK-1 & HK-3 on same base.

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For the first time anywhere, Poly Pak merchandisers introduce a new way in buying the economical way. Raw stock from the "barrel". Remember the "good ole days"? They're back again. The same way merchandisers throughout the United States buy from various factories . . . their overruns in barrels. Poly Pak has done the same. Therefore you are getting the same type of material as the RE-TESTERS DO!

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Buy 10 BARREL KITS AND CHOOSE THE 11TH KIT Free

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☐ LM709N	5 for 1.19	
☐ LM710N	2 for 1.19	
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☐ LM741V	4 for 1.19	
☐ LM747N	2 for 1.19	
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☐ LM1800N	3 for 2.50	
☐ LM3900N	3 for 1.19	
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Code N=TO5 case. V=Mini Dip, N=DIP.

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6V INDICATORS w/leads
15 for $1.98
Test lamp manufacturer dumps inventory! Worth 69¢ ea. Like grain-o-wheat. Cat. No. 2A 3826

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9 DIGIT READOUT MODULES
5 for $1.98 with calculator & driver chips beneath epoxy Cat. No. 2A 3818

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CARBO-FILM RESISTORS
75 for $1.98
Hard to find! but we got millions. Lo & Hi values. ¼ and ⅛ watt, 5%, 10% tol. All marked. 100% good. 2A 3825

BARREL KIT #106
400 Parts $1.98
Includes resistors, caps, transformers, rectifiers, diodes, etc. for p.c. work. Preformed, dumped into barrels by factories. 100%. Cat. No. 2A 3401

BARREL KIT #107
KEYBOARD CHIPS
10 for $1.98
Truthfully we can't test 'em, MM6740's, keyboard encoder chips. How good they are we don't know. Cat. No. 2A3414

BARREL KIT #184
¼-WATT METAL FILM
150 for $1.98
100% metal film resistors. Long leads. 2A 3413

BARREL KIT #182
JUMBO RED LEDS
15 for $1.98
100% material, laser cancellation from factory dumps. 3V 10 mils. For 100's of projects, red lens. Cat. No. 2A 3369

BARREL KIT #103
MINI TRIM POTS
30 for $1.98 1 oz.
Asst. values 100 to 1 meg 'em. What a buy. Single turn. ¼ W. Wt. 6 oz. Cat. No. 2A 3368

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'POP' PLASTIC TRANSISTORS
25 for $1.98
2N5904's with some 2N3906's of 100% material. TO-92. Preformed. Cat. No. 2A 3349 1 oz.

BARREL KIT #169
V. REGULATORS
15 for $1.98
LM309KC TO-3 V.R.'s barreled. But by the pound, No. 2A 3330

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MODULAR SWITCHES
25 for $1.98
Centralab switches, TV-makers ov. cross, Dpdt, 6pdt, etc. Brand new. Cat. No. 2A 3150

BARREL KIT #186
MAGNIFIED MAN-3's
15 for $1.98 1 oz.
MAN-3, 7-seg readout, with built-in magnifier. Factory discontinued line, 100% material. Cat. No. 2A3333

BARREL KIT #187
MOLEX CONNECTORS
100 for $1.98 12 ozs.
Nylon, white cable connectors, asst. factory over-run. NO PICKEE! Mixed in barrels. Cat. No. 2A 3326

BARREL KIT #154
CLOCK CHIPS
20 for $1.98
We gathered an assortment of clock chip, alarm, calendar, beepers, who knows, all mixed. Cat. No. 2A 3206

BARREL KIT #145
MINI TRANSFORMER
15 for $1.98
Miniature transformer back again. Asst. outputs, interstags and audio. Only 1½ oz. Wt. 2 lbs. 2A 3284

BARREL KIT #144
RCA PHONO PLUGS
40 for $1.98
1,000,000 RCA phono plugs for this one. You hi-fi-ers know wat they are . . . 100% material. 2A 3293

BARREL KIT #143
75-PC TRANSISTORS
$1.98
100% material, TO-92, factory discontinued lines, prep's mixed with npns. 2N4400-1-2-3-4. 2A 3290

BARREL KIT #138
PANEL SWITCHES
30 for $1.98
Did you hear of OAK? Another copt maker barrelled all types of rotaries, slide, tactile, etc. 2A 3346

BARREL KIT #134
CALCULATOR CHIPS
15 for $1.98
National type, such as MM5736, 38, etc. Untested. Cat. No. 2A 3258

BARREL KIT #133
C-MOS IC'S
60 for $1.98
Deliberately thrown in barrels, so we can't test 'em! The famous CD4000 series. How good? Who knows? Cat. No. 2A 3297

BARREL KIT #131
TANTALUM ELECTROS
30 for $1.98
Mixed, marked prime, top grade asst. values, voltages. Cat. No. 2A 3285

BARREL KIT #128
MINI DIP ICS
75 for $1.98
Large mfgr dumped 100's of lbs into barrels. Includes 741s, LM-380-8, 703, 567, 555, 558—but who knows? Wt. 1 lb. 2A 3249

BARREL KIT #127
AXIAL ELECTROS
40 for $1.98
Asst. capacities and voltages. Cat. No. 2A 3227

BARREL KIT #126
UPRIGHT ELECTROS
40 for $1.98
1mf to 300mf in mixture voltage. 100% marked 'n good. 2A 3226

BARREL KIT #119
PRECISION RESISTORS
100 for $1.98
PREFORMED! Designed for printed circuit work. ¼, ½ w. Marked values, 1 and 2% values. 2 ozs. 2A 3205

BANNEL KIT #118
MINI SCRS
50 for $1.98
UNBELIEVABLE! TO-92 plastic SCRS in barrels . . . rite from factory. Includes all voltages up thru 200 prv. 2A 3138

BARREL KIT #115
MOLEX SOCKETS 100% good
200 for $1.98 Cat. No. 2A 3144
Calculator maker dump! We got a zillion of 'em. Used for IC sockets, etc.

BARREL KIT #112
MICRO MINI LEDS
40 for $1.98
All the tiny leds, axial, upright of Monsanto, Litronix, variety of colors. Yield 50% or better. 2A 3139

BARREL KIT #109
TERMINAL STRIPS
100 for $1.98
Wide asst. of terminal strip connectors, from 1 contact up. Strip manufacturers barrel dump in your gain. Wt. 1 lb. Cat. No. 2A 3126

BARREL KIT #104
SLIDE VOLUME CONTROLS
10 for $1.98
Cat. No. 2A 1057

BARREL KIT #101
RESISTOR SPECIAL
200 for $1.98
Includes: ¼, ½, ½, 1, 2 watters, carbon. 8 ozs. 100% good. 2A 3054

BARREL KIT #99
PHOTO ELECTRIC CELLS
10 for $1.98
Asst. GE types, CDS types. Mixed by factory. Big job for us to separate. 100% good. Cat. No. 2A 3052

BARREL KIT #93
HALF WATTERS
200 for $1.98
Resistor factory tried to sort us by mixing 100's color-coded resistors in barrel. But value is there. 4 oz. 2A 3046 Untested

BARREL KIT #92
3 AMP EPOXY RECTIFIERS Untested
100 for $1.98
Cosmetic rejects, electrically fine businessss! You check 'em, it's not for us. Asst. voltages. 2A 3204

BARREL #91
SILVER MICAS
100 for $1.98
Axial, red case, variety of typical mica & values. Cat. No. 2A 3018

BARREL KIT #86
LITRONICS LED READOUTS
10 for $1.98
747's, 727's, singles, triples, etc. .33 to 0.6. But from factory, all mixed; have fun! No. 2A 3261

BARREL KIT #87
NATIONAL IC BONANZA
100 for $1.98
Types 8000, 7400 series, DTL's, ROMs, registers, clock & calc. chips, linears, etc. Cat. No. 2A 2800 Untested.

BARREL KIT #86
HOBBY LEDS
40 for $1.98 Untested
Wow! A Litronics dump of all kinds of mixed discrete LED'S, shapes, colors good, poor, etc. 2A 2859

BARREL KIT #83
15 for $1.98
LM-340T VOLT REG
Factory rejected these. Any length of leads. May include 5, 6, 8, 12, 15, 18, 24 volts. Power tab Cat. 2A 3035

BARREL KIT #81
SUBMINI RESISTORS
200 for $1.98
PC, upright type, color coded, ¼ watt. Asst values. Come to us in a barrel. Cat. No. 2A 2746 100% good

BARREL KIT #76
1-WATT ZENERS
100 for $1.98
Factory same as 400-mw's. Never-to-see-again offer. 6, 9, 10, 12, 15V. under glass. Double plug. Cat. No. 2A 2741 Untested.

BARREL KIT #75
400MW ZENERS
150 for $1.98
Factory out of bis! Amazing offer: 6, 8, 10, 12 to 15V. Yes 'cept, Hermetically sealed glass pak. Double plug. Cat. No. 2A2740

BARREL KIT #73
TRANSISTOR ELECTROS
50 for $1.98
We don't wish to separate wide asst voltages & values up to 300 mf. Cat. No. 2A 2747

BARREL KIT #71
CAPACITOR SPECIAL
100 pcs. $1.98
micas, molded, plastics, ceramics, discs, etc. Nifty 100% good Cat. No. 2A 2736

BARREL KIT #68
2 WATTERS
100 for $1.98 100% good.
All marked. Cat. No. 2A 2735

BARREL KIT #65
MIXED READOUTS
10 for $1.98
Factory returns — such numbers as MAN-4's, MAN-7's, MAN-3's, 11 barrels & no time to separate. Cat. No. 2A 2733 Untested.

BARREL KIT #63
MIXED IC'S
100 for $1.98
All shapes; 7400 Series, 8000, 9000, ROMS, RTL's, DTL's, linears of all kinds. Cat. No. 2A 2730

BARREL KIT #61
POLYSTYRENE CAPS
100 for $1.98
Finest cape made. As a gambie we bought 10 barrels from factory, mixed values; all good. Cat. No. 2A 2729

BARREL KIT #58
SLIDE SWITCHES
30 for $1.98
All shapes, sizes, spst, dpst, momentaries, etc. Treneadous shop pak for 100's of switching projects. Cat. No. 2A 2726 100% good

BARREL KIT #56
POWERS! POWERS!
100 for $1.98
Large distributor cleaned house. Barrels of power resistors 3 to 7 watts. Cat. No. 2A 2724

BARREL KIT #54
8 DIGIT READOUTS
10 for $1.98
Bargain of a lifetime! All we got was 1 barrel — the "blinder digit" types. Multiplexed. Cat. No. 2A 2722

BARREL KIT #48
741 MINI DIP "BONANZA"
50 for $1.98
Barrels 'n barrels of 'im This is a buyer's market. How many can we get tested. Cat. No. 2A 2628

BARREL KIT #46
G.E. 3.5 WATT AMPLIFIERS
25 for $1.98
Hobby type, factory fallouts. 2A 2624 Untested

BARREL KIT #40
PNP HIGH-POWER TRANSISTORS
20 for $1.98
Popular germanium TO-3 case 2A 2618 100% good

BARREL KIT #39
2N3055 HOBBY TRANSISTORS
15 for $1.98
Fallouts of the famous 2N3055. 2A 2617 100%

BARREL KIT #37
1 AMP "BULLETT" RECTIFIERS Untested
100 for $1.98
Famous style, asstd. voltages, silicon, axial includes all types of voltages to 1KV. Cat. No. 2A 2615

BARREL KIT #35
NEON LAMPS
30 for $1.98 100% good.
Famous NE-2's. All prime, but factory made millions and barrel'ed 'em. Your advantage Cat. No. 2A 2613

BARREL KIT #31
METALLIC RESISTORS
100 for $1.98
Made mostly by Corning, the finest resistor made. Mostly ⅓ watters. 1% to 10% tol. In a barrel of values. Cat. No. 2A 2609

BARREL KIT #30
PREFORMED RESISTORS
200 for $1.98
We got barrels of ¼ and ½" watters for pc use. 100: ¼, 100 ½" watters. No. 2A 2608 100% good

BARREL KIT #27
PREFORMED DISCS
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BARREL KIT #24
PLASTIC TRANSISTORS
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METAL CAN TRANSISTORS
100 for $1.98
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POWER TAB TRANSISTORS
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NPN, plastic TO220 type. Assorted 2N numbers. No. 2A 2425 Untested.

BARREL KIT #10
ROMS-REGISTERS
75 for $1.98
24 to 40 pin devices, marked, internal factory numbers, etc. 2A 2424 Untest

BARREL KIT #8
SUBMINIATURE IF TRANSFORMERS
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100 for $1.98
Imagine famous switching diodes at these prices! Cat. No. 2A 2418 Untested.

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75 for $1.98
Untested
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YOU GET:
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BUILD YOUR OWN ULTRASONIC MOTION DETECTOR FOR USE IN INTRUSION DETECTORS, DOOR OPENERS, OBJECT COUNTERS, ETC. WE INCLUDE COMPLETE SPECS AND RECOMMENDED CIRCUITS.

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Kit includes all parts
Plug compatiblewith DIGITRAN® KEYBOARDS
Complete with PC Board

Same as above but less Audio output and PTT circuit. Smaller size permits use with handitalkies. $10.00 TE–02

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A FULL 6 DIGIT LED READOUT CLOCK THAT GIVES 24 HOUR (ZULU) REALTIME AND ELAPSED TIME IN SECONDS, MINUTES AND HOURS UP TO 24 HOURS. READOUTS CAN BE TURNED OFF OR DIMMED PC BOARDS ARE SMALL TO FIT INSIDE A STANDARD INSTRUMENT CASE (2¼" Dia.)

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Quality plated boards
Real Time (24 hr.)
Elapsed Time
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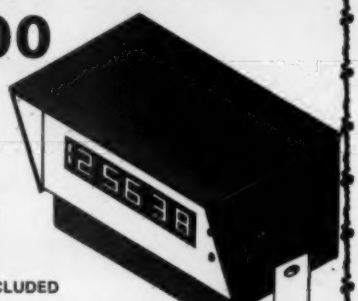
12V NEG GND

KIT IS SUPPLIED WITHOUT SWITCHES OR CASE

MOBILE CLOCK KIT

COMPLETE WITH PRE–PUNCHED CUSTOM CASE AND MOUNTING BRACKET. CASE IS HEAVY GAUGE ALUMINUM WITH A BLACK WRINKLE FINISH TOP AND WHITE FRONT.
12 HOUR FORMAT ONLY.
CLOCK HAS ALARM CAPABILITY (extra parts needed).

$25.00
COMPLETE!



MK-04

- 6 DIGIT LED
- .4" READOUT
- TIMEBASE INCLUDED

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A special buy on a high quality ultrasonic transducer allows us to offer this kit at a super price – but hurry, quantities are limited! You can build intrusion alarms, motion detectors, remote controls, echo ranging or liquid level measurement equipment. We supply the basic transmitter and receiver electronics including a drilled and plated PC board. The units work at 23KHZ with a range of 20 ft. and can be positioned opposite each other or side-by-side and bounced off a solid surface. The output will sink up to 300ma to drive a relay, alarm circuit, etc.

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CASES ARE HEAVY GAUGE ALUMINUM WITH BAKED WHITE FINISH & BLACK WRINKLE TOPS.

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POSITIVE REGULATOR 500ma
VARIABLE FROM 3 to 30 VDC
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Code Practice Oscillator
Continuity Checker
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Tone varies with resistance

$1.95 (kit)

MEASURE CONTINUITY & RESISTANCE TO 2K
TEST LED's, DIODES, AND TRANSISTORS. LESS SPEAKER.

Requires 3 to 6 volt batteries (not included)

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2N2926G ..... .24
2N2926Y ..... .24
2N3053 ..... .50
2N3390 ..... .75
2N3439 ..... 1.59
2N3440 ..... .60
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FND 359	.3	1.35
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Power Requirements +5 V, +15V & -15 V.

NOW NEW IMPROVED DIGITAL ALARM CLOCK KIT Hours • Minutes • Seconds displayed on six BIG 0.5 Fairchild 7 Segment Display LEDS 12-hour format 24-hour alarm with snooze feature, plus elasped time indicator and freeze feature. Eight pages of pictorials and instructions. NEW on-board power transformer and circuitry for optional time base $19.99
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LASER DIODES – 6 to 9.5 WATTS

These gallium arsenide injection diodes emit coherent infra red radiation. The diode is built in a hetero-junction structure, consisting of three distinct layers: N-type; P-type gallium arsenide; and P-type gallium aluminum arsenide. The device is hermetically sealed in an optically centered coaxial package with an 8-32 screw stud. CH: 6 ot 9.5 watts, I_{fm}= 40A, I_{th}=12A, typical peak forward voltage at I_{fm}= 6.7 volts, at 50 ma. = 1.2 volts. Quantity is limited. Complete with spec. sheet.

Sh. Wt. 4 oz. . . . . .6MI60464 . . . . . $6.80
3 for $20.00 . . . . .6MI60464 . . . . $20.00/3

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A complete, factory rebuilt, modern telephone ready for instant use. Available in black, white, beige, pink, red, green and blue. Ideal as an extra phone, for use on intercoms, private systems, extensions, etc. Easy 3-wire hook-up. Phones include hand set, induction coil, and cable, but no ringers. Many types and styles available, please give 3 choices when ordering a color phone. Spec sheets with wiring diagrams are included, not detectable, Phones may vary slightly from photo.

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Sh. Wt. 8 Lbs(black) . . .6VL60442 . . $10.00
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† Standard Desk Touch Tone Phone
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† 2 Line Standard Desk Dial Phone
This phone has a twist key to switch in 2 lines over the same phone, plus a "hold" position.
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† "Call Director" Office Style Desk Phone
This dial phone handles 10 lines, and has hold and intercom buttons.
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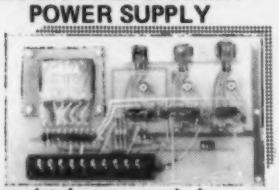
† TI 305: 5x7 matrix LED display . . . $5.00
† HP 5082-7300: 4x7 matrix $5.00
† ½" LCQ: 8.5 digit display in socket, with calculator board . . . . 6MI60493. . . . $3.00
† Tung-Sol 1705 or 1704: ½" 7-seg. . . . $1.00
† FND503: Red, com. cath., ½" rhdp . . $1.25
† B 5755 S (=B5750) ½" neon $1.00
† B 7971: 2½" alpha/num. neon $1.00

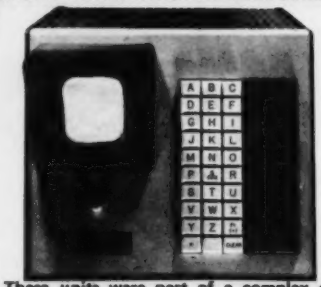
LOGIC AND OP. AMP. POWER SUPPLY



This regulated power supply has outputs of ±15 volts at 0.25 amps and +5 volts at 2.5 amps, input is 115 volts AC. Manufactured by a computer company as part of a phone data terminal. These units use three 723's (IC's) for regulation, and have barrier strip outputs. Power supplies are open frame, size: 5"x 9"x 2". New surplus, quanity is limited.

Sh. Wt. 5 Lbs . . . . .6MI60215 . . . . $17.50
3 for $45.00 . . . . .6MI60215 . . . . $45.00/3

INPUT/OUTPUT TERMINAL
GREAT FOR MICROPROCESSORS!



These units were part of a complex computer system. The terminal contains: ASC11 keyboard; CRT; drive circuits; and a complete 128 page tech. manual with operating and repair instructions, which makes it easy to modify the terminal for your applications. (Character generation unit was in a separate control device which is not supplied, but the terminal can be used with character generator LSI chips, such as the 2513 or 2516.)

The keyboard is a 50 key alpha-numeric (and others) block keyboard, with ASCII encoding. Display capacity is 768 (12 lines of 64), 384, 256, 128 and so on, depending on the size of characters desired. The character size may be adjusted from approximately typewriter size up to ¼".

The viewing screen of the CRT utilizes a high contrast, low persistence, emerald green phosphor. Each character is composed from a 5x7 dot pattern, registering clearly and sharply against a dark background. Controls provided include: on/off; brightness; focus; and character height.

Great as a microprocessor input and output device. The display stations are used, from airline reservation systems, stock exchanges, hotel reservation systems, etc.

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This cage has 37 P.C. board edge connectors for 1/16" thick cards. Connectors are wire wrap type with double edge contacts, 0.125" spacing. The card rack has 18 rows of 2 types of connectors: 30 contact and 86 contact types. Overall dimensions: 18" long; 11" wide; and 10" high. Reomved from used equipment, this was once part of a data display terminal.

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We basicly have two chassis', the TS951 and the TS953, used to drive either 13", 15" or 19" picture tube. Parts to be added to the 19" chassis to make a complete TV include: UHF and VHF tuners, picture tube, tube shield, purity magnets, antenna, yoke, speaker, on-off switch, four 10K pots, binding posts and case.

Parts needed to make a complete 13" or 15" TV include: picture tube, tube shield, yoke, purity magnets, antenna, 2nd stage hi-voltage boost, binding posts, and case.

We do not have a complete package, but we do have some parts available at this time. By adding a picture tube, case and a few parts, you can have a going Color TV for less than half the price of a store bought set.

PRICE LIST

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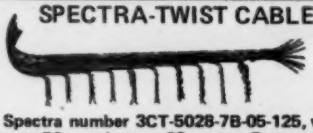
TV Speaker . . . . . .6Z60177. . . . . $3.50
Binding Post Assembly, UHF, VHF
4MI00422. . . . . $1.50

SPECTRA-TWIST CABLE



Spectra number 3CT-5028-7B-05-125, which means 50 conductor, 28 guage, 7 strands per conductor. Cable is made up of twisted pairs, which can be used in place of shielded cable to reduce or eleiminate cross-talk while saving space. Spacing tolerance of ±0.033". Great for wiring of microprocessors, etc. Sh. Wt. 3 oz./ft. Order No. 6H60265 . Prices: 1 foot for $1.25; 10' & up for $0.90/ft.; 50' & up for $0.80/ft.; 100' & up for $0.69/ft.; 500' & up for $0.60/ft.

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10	6H60528	15	15	$8.00 ea.
15	6H60529	24(CT)	5	
		24 or 32	3	$10.00 ea.
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		12	2	
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* Ferro-Resonant type.
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74LS10	.29	74LS164	2.49	74LS164	2.25
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74LS14	1.15	74LS190	1.25	74LS191	3.69
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	.125" dia.			.195" dia.			.250" dia.			.500" dia.	
XC209	Red	10/$1	XC525	Red	10/$1	XC586	Red	10/$1	XC111	Red	10/$1
XC209	Green	4/$1	XC526	Green	4/$1	XC586	Green	4/$1	XC111	Green	4/$1
XC209	Orange	4/$1	XC526	Yellow	4/$1	XC586	Yellow	4/$1	XC111	Yellow	4/$1
			XC526	Orange	4/$1	XC586	Orange	4/$1	XC111	Orange	4/$1
	.200" dia.			.195" dia.			.200" dia.			.600" dia.	
XC22	Red	10/$1	XC526	Red	10/$1	XC586	Red	10/$1	MV50		
XC22	Green	4/$1	XC526	Green	4/$1	XC586	Green	4/$1	.600" dia. Micro		
XC22	Yellow	4/$1	XC526	Yellow	4/$1	XC586	Yellow	4/$1	red LED		
XC22	Orange	4/$1	XC526	Orange	4/$1	XC586	Orange	4/$1	6/$1		
SSL-22	RT	4/$1	XC526	Clear	4/$1	XC566	Clear	7/$1			

DISPLAY LEDS

DL707 DL338

TYPE	POLARITY	HT	TYPE	POLARITY	HT		
MAN 1	Common Anode	270	2.95	MAN 3620	Common Anode-orange	300	1.75
MAN 2	5 x 7 Dot Matrix	300	4.95	MAN 3640	Common Cathode-orange	300	1.75
MAN 3	Common Cathode	125	.39	MAN 4710	Common Anode-Red	400	1.95
MAN 4	Common Cathode	187	1.95	DL701	Common Anode-red	300	-
MAN 7	Common Anode	300	1.25	DL704	Common Cathode	300	-
MAN 7G	Common Anode-green	300	1.95	DL707	Common Anode	300	-
MAN 7Y	Common Anode-yellow	300	1.95	DL 728	Common Cathode	500	-
MAN 52	Common Anode-green	300	1.75	BL 747	Common Cathode	600	2.25
MAN 64	Common Anode red	400	1.75	DL 750	Common Cathode	600	2.49
MAN 72	Common Anode	300	1.25	DL 338	Common Cathode	110	50
MAN 74	Common Cathode	300	1.50	FND70	Common Cathode	250	.75
MAN 82	Common Anode-yellow	300	1.75	FND503	Common Cathode	500	1.00
MAN 84	Common Cathode-yellow	300	1.75	FND507	Common Cathode	500	1.00

IC SOLDERTAIL — LOW PROFILE (TIN) SOCKETS

	1-24	25-49	50-100
8 pin	$.17	16	15
14 pin	.20	19	18
16 pin	.22	21	20
18 pin	.26	26	27
22 pin	.37	36	35

SOLDERTAIL STANDARD (TIN)

14 pin	$.27	25	24
16 pin	.30	27	25
18 pin	.33	32	30
24 pin	.40	45	42

SOLDERTAIL STANDARD (GOLD)

8 pin	$.30	27	24
14 pin	.35	32	29
16 pin	.38	35	32
18 pin	.52	47	43

WIRE WRAP SOCKETS (GOLD) LEVEL #3

10 pin	$.45	41	37
14 pin	.39	38	37
16 pin	.43	42	41
18 pin	.75	68	62

	1-24	25-49	50-100
24 pin	$.38	37	36
28 pin	.45	44	43
36 pin	.60	59	58
40 pin	.63	62	61
28 pin	$ .98	96	81
36 pin	1.39	1.26	1.15
40 pin	1.59	1.45	1.30
24 pin	$.01	95	83
28 pin	1.40	1.35	1.18
36 pin	1.59	1.45	1.30
40 pin	1.75	1.55	1.40

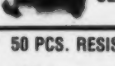
PUSH BUTTON SWITCH

SPDT

PB-123	$1.75
Maintained Action Switch	
PB-126	$1.75
Momentary Action Switch	

MINATURE TOGGLE SWITCH

JMT-221	DPDT	on/off/on	$1.95
JMT-223	DPDT	on/none/on	$1.75
JMT-121	SPDT	on/off/on	$1.50
JMT-123	SPDT	on/none/on	$1.25



CLIPLITE NEW LED MOUNTING SYSTEM — to be used with XC556 LEDS — **SPECIFY COLORS** — RED — GREEN — AMBER — YELLOW **4/$1.00**

50 PCS. RESISTOR ASSORTMENTS $1.75 PER ASST.

ASST. 1	5 ea.	10 OHM	12 OHM	15 OHM	18 OHM	22 OHM	1/4 WATT 5%	50 PCS.
		27 OHM	33 OHM	39 OHM	47 OHM	56 OHM		
ASST. 2	5 ea.	68 OHM	82 OHM	100 OHM	120 OHM	150 OHM	1/4 WATT 5%	50 PCS.
		180 OHM	220 OHM	270 OHM	330 OHM	390 OHM		
ASST. 3	5 ea.	470 OHM	560 OHM	680 OHM	820 OHM	1K	1/4 WATT 5%	50 PCS.
		1.2K	1.5K	1.8K	2.2K	2.7K		
ASST. 4	5 ea.	3.3K	3.9K	4.7K	5.6K	6.8K	1/4 WATT 5%	50 PCS.
		8.2K	10K	12K	15K	18K		
ASST. 5	5 ea.	20K	27K	33K	39K	47K	1/4 WATT 5%	50 PCS.
		56K	68K	82K	100K	120K		
ASST. 6	5 ea.	150K	180K	220K	270K	330K	1/4 WATT 5%	50 PCS.
		390K	470K	560K	680K	820K		
ASST. 7	5 ea.	1M	1.2M	1.5M	1.8M	2.2M	1/4 WATT 5%	50 PCS.
		2.7M	3.3M	3.9M	4.7M	5.6M		

ASST. 8R Includes Resistor Assortments 1-7 (350 PCS.) **$10.95 ea.**

$5.00 Minimum Order — U.S. Funds Only
California Residents — Add 6% Sales Tax

Spec Sheets - 25¢ — Send 24¢ Stamp for 1977 Catalog
Dealer Discount Available — Request Pricing

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James ELECTRONICS

1021-A HOWARD AVE., SAN CARLOS, CA. 94070
PHONE ORDERS WELCOME — (415) 592-8097
All Advertised Prices Good Thru February

WIRE WRAP CENTER

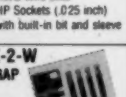
CORDLESS HOBBY-WRAP TOOL-BW-630

- Battery Operated (Size C)
- Weighs ONLY 11 Ounces
- Wraps 30 AWG Wire onto Standard DIP Sockets (.025 inch)
- Complete with built-in bit and sleeve

$34.95 (batteries not included)

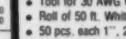
WIRE-WRAP KIT — WK-2-W

WRAP • STRIP • UNWRAP



- Tool for 30 AWG Wire
- Roll of 50 ft. White 30 AWG Wire
- 50 pcs. each 1", 2", 3" & 4" lengths — pre-stripped white wire

$11.95



WIRE WRAP TOOL WSU-30
WRAP • STRIP • UNWRAP - $5.95

WIRE WRAP WIRE — 30 AWG

25 ft. min. $1.25 50 ft. $1.95 100 ft. $2.95 1000 ft. $15.00
SPECIFY COLOR — White - Yellow - Red - Green - Blue - Black

THUMBWHEEL SWITCHES

THUMBWHEEL SWITCH ONLY

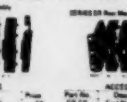
Part No.	Description	Price
SF 12	Single Pole 10 Position	$2.50
SR 10	Decimal	2.00
SF 21	10 Position BCD only	2.90
SR 21		3.00

Ordering: Order desired switch or switches and add necessary accessories for your particular application

SF - Front Mount SR - Rear Mount

BRAND 57 Front Mount Assembly

SERIES 58 Rear Mount Assembly



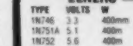
ACCESSORIES

Part No.	Description	Price
SF EP	End Plate (Pair)	.40
SF DP	Divider Plate (each)	.40
SF BB	Blank Body (each)	.40
SF HB	Half Body (each)	.40

ACCESSORIES

Part No.	Description	Price
SR EP	End Plate (pair)	$ .50
SR DP	Divider Plate (each)	.40
SR BB	Blank Body (each)	.40
SR HB	Half Body (each)	.40

DIP SWITCH



These switches feature seven SPST slide switches in a molded dip. They are ideally suited for microprocessor applications.

$1.95

ZENERS — DIODES — RECTIFIERS

TYPE	VOLTS	W	PRICE	TYPE	VOLTS	W	PRICE
1N746	3.3	400mw	4/1.00	1N4005	600 PIV 1 AMP		10/1.00
1N751A	5.1	400m	4/1.00	1N4006	800 PIV 1 AMP		10/1.00
1N752	5.6	400m	4/1.00	1N4007	1000 PIV 1 AMP		10/1.00
1N753	6.2	400m	4/1.00	1N3600	50	200m	6/1.00
1N754	6.8	400m	4/1.00	1N4148	75	10m	15/1.00
1N958	8.2	400m	8/1.00	1N4154	35	10m	12/1.00
1N5985	15	400m	4/1.00	1N4383	75	25m	30/1.00
1N5232	5.6	500m	2/$	1N4734	5.6	1w	2/$
1N5234	6.2	500m	2/$	1N4735	6.2	1w	2/$
1N5235	6.8	500m	2/$	1N4736	6.8	1w	2/$
1N5236	7.5	500m	2/$	1N4738	8.2	1w	2/$
1N458	25	40m	6/1.00	1N4742	12	1w	2/$
1N468	150	7m	6/1.00	1N4744	15	1w	2/$
1N485A	180	10m	6/1.00	1N1183	50 PIV	35 AMP	1.60
1N4001	50 PIV	1 AMP	12/1.00	1N1184	100 PIV	35 AMP	1.70
1N4002	100 PIV	1 AMP	12/1.00	1N1185	150 PIV	35 AMP	1.80
1N4003	200 PIV	1 AMP	12/1.00	1N1186	200 PIV	35 AMP	1.80
1N4004	400 PIV	1 AMP	12/1.00	1N1188	400 PIV	35 AMP	3.60

SCR AND FW BRIDGE RECTIFIERS

C35D	15A @ 400V	SCR	$1.95
C38M	25A @ 200V	SCR	1.95
2N2323B	1.6A @ 200V	SCR	.50
MDA 980-1	12A @ 50V	FW BRIDGE REC.	1.95
MDA 980-3	12A @ 200V	FW BRIDGE REC.	1.95

TRANSISTORS

MPS A05	5/$1.00		PN3567	3/$1.00	PN4249	4/$1.00
MPS A06	5/$1.00		PN3568	4/$1.00	PN4250	4/$1.00
2N2219A	3/$1.00		PN3569	4/$1.00	2N4401	4/$1.00
2N2221	4/$1.00		PN3638A	4/$1.00	2N4402	4/$1.00
2N2222A	5/$1.00		PN3704	5/$1.00	2N4403	4/$1.00
2N2369	5/$1.00		PN3705	5/$1.00	2N4409	5/$1.00
2N2369A	4/$1.00		PN3706	5/$1.00	2N5086	4/$1.00
PN2415	5/$1.00		PN3707	5/$1.00	2N5087	4/$1.00
2N2484	4/$1.00		2N3711	5/$1.00	2N5088	4/$1.00
2N2906A	4/$1.00		2N3724	$ .60	2N5089	4/$1.00
2N2907A	5/$1.00		2N3725	$1.00	2N5129	5/$1.00
2N2925	5/$1.00		2N3903	5/$1.00	2N5130	5/$1.00
2N3053	2/$1.00		2N3904	4/$1.00	2N5136	5/$1.00
2N3055	$ .69		2N3905	4/$1.00	2N5269	5/$1.00
MJE3055	$1.00		2N3906	4/$1.00	2N5951	5/$1.00
MJE2955	$1.25		2N4013	3/$1.00	C106B1SCR	2/$1.00
2N3392	5/$1.00		2N4014	3/$1.00	2N5432	$2.00
2N3398	5/$1.00		2N4123	10/$1.00		

CAPACITOR CORNER

50 VOLT CERAMIC DISC CAPACITORS

	1-9	10-49	50-100
10 pf	.05	.04	.03
22 pf	.05	.04	.03
47 pf	.05	.04	.03
100 pf	.05	.04	.03
220 pf	.05	.04	.03
470 pf	.05	.04	.035

	1-9	10-49	50-100
001pF	.05	.04	.035
.0047	.05	.04	.035
.01	.05	.04	.035
.022	.05	.04	.04
.047	.05	.04	.04
.1	.12	.09	.075

100 VOLT MYLAR FILM CAPACITORS

.001mf	.12	.10	.07
.0022	.12	.10	.07
.0047	.12	.10	.07
.01	.12	.10	.07

.022mf	.13	.11	.08
.047	.21	.17	.13
.1	.27	.23	.17
.22	.33	.27	.22

+20% DIPPED TANTALUMS (SOLID) CAPACITORS

1/35V	.29	.23	.17
10/35V	.38	.23	.17
.22/35V	.29	.23	.17
.33/35V	.29	.23	.17
.47/35V	.29	.23	.17
.68/35V	.29	.23	.17
1.0/35V	.29	.23	.17

1.5/35V	.30	.26	.21
2.2/35V	.31	.27	.22
3.3/25V	.31	.27	.22
4.7/25V	.32	.28	.23
6.8/25V	.36	.31	.25
10/25V	.40	.35	.29
15/25V	.53	.39	.40

MINIATURE ALUMINUM ELECTROLYTIC CAPACITORS

Axial Lead				Radial Lead			
47/50V	.15	.13	.10	47/25V	.15	.13	.10
1.0/50V	.16	.14	.11	47/50V	.16	.14	.11
3.3/50V	.15	.13	.10	1.0/16V	.15	.13	.10
4.7/25V	.16	.14	.12	1.0/25V	.16	.14	.11
10/25V	.15	.13	.10	1.0/50V	.16	.14	.11
10/50V	.16	.14	.12	4.7/16V	.15	.13	.10
22/25V	.17	.15	.12	4.7/25V	.15	.13	.10
22/50V	.24	.20	.18	4.7/50V	.16	.14	.11
47/25V	.19	.17	.15	10/16V	.14	.12	.09
47/50V	.25	.21	.19	10/25V	.15	.13	.10
100/25V	.24	.20	.18	10/50V	.16	.14	.12
100/50V	.35	.30	.28	47/50V	.31	.21	.19
220/25V	.32	.28	.25	100/16V	.19	.15	.14
220/50V	.45	.41	.38	100/25V	.31	.28	.18
470/25V	.33	.29	.27	100/50V	.35	.30	.28
1000/16V	.55	.50	.45	220/16V	.23	.17	.16
2200/16V	.70	.62	.53	470/25V	.31	.28	.26

KENWOOD
...pacesetter in amateur radio

TS-820 Specifications

FREQUENCY RANGE: 1.8-29.7 MHz
(160 - 10 meters)
MODES: USB, LSB, CW, FSK
INPUT POWER: 200W PEP on SSB
160 W DC on CW
100 W DC on FSK
ANTENNA IMPEDANCE: 50-75 ohms, unbalanced
CARRIER SUPPRESSION: Better than 40 dB
SIDEBAND SUPPRESSION: Better than 50 dB
SPURIOUS RADIATION: Greater than -60 dB
(Harmonics more than -40 dB)
RECEIVER SENSITIVITY: Better than 0.25uV
RECEIVER SELECTIVITY:
SSB 2.4 kHz (-6 dB)
4.4 kHz (-60 dB)
CW* 0.5 kHz (-6 dB)
1.8 kHz (-60 dB)
*(with optional CW filter installed)
IMAGE RATIO: 160-15 meters: Better than 60 dB
10 meters: Better than 50 dB
IF REJECTION: Better than 80 dB
POWER REQUIREMENTS: 120/220 VAC,
50/60 Hz, 13.8 VDC (with optional
DS-1A DC-DC converter)
POWER CONSUMPTION: Transmit: 280 Watts
Receive: 28 Watts (heaters off)
DIMENSIONS: 13-1/8" W x 6" H
x 13-3/16" D
WEIGHT: 35.2 lbs (16 kg)

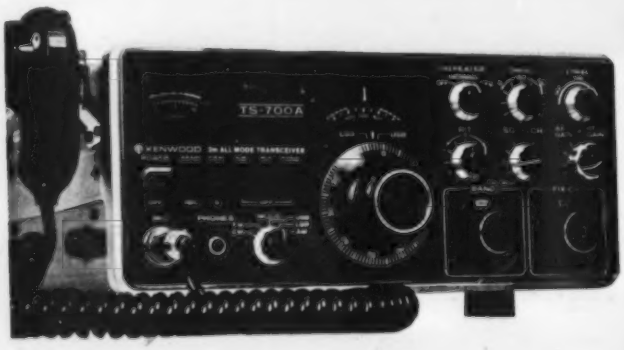
Kenwood's TS-520 has *sold itself* to thousands of amateurs the world over.

The value of its features and specifications are obvious. But just as important is the kind of quality that Kenwood builds in. Hundreds of testimonials on the air attest to its performance and dependability. You probably have heard of some of the same glowing praise.

The TS-520 operates SSB and CW on 80 through 10 meters and features built-in AC and 12VDC power supply.

TS-520 Specifications

MODES: USB, LSB, CW
POWER: 200 watts PEP input on SSB, 160 watts DC input on CW
ANTENNA IMPEDANCE: 50-75 Ohms, unbalanced
CARRIER SUPPRESSION: Better than -45 dB
UNWANTED SIDEBAND SUPPRESSION: Better than -40 dB
HARMONIC RADIATION: Better than -40 dB
AF RESPONSE: 400 to 2600 Hz (-6 dB)
AUDIO INPUT SENSITIVITY: 0.25μV for 10 dB (S+N)/N
SELECTIVITY: SSB 2.4 kHz (-6 dB), 4.4 kHz (-60 dB). CW 0.5 kHz (-6 dB), 1.5 kHz (-60 dB) (with accessory filter)
FREQUENCY STABILITY: 100 Hz per 30 minutes after warmup
IMAGE RATIO: Better than 50 dB
IF REJECTION: Better than 50 dB
TUBE & SEMICONDUCTOR COMPLEMENT: 3 tubes (2 x 6146B, 12BY7A), 1 IC, 18 FET, 44 transistors, 84 diodes
DIMENSIONS: 13.1" W x 5.9" H x 13.2" D
WEIGHT: 35.2 lbs.



KENWOOD'S TS-700A finally fulfills the promise of 2-meters... more channels, more versatility, tunable VFO, SSB-CW and, best of all, the type of quality that has placed the Kenwood name out front.

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8400 N. Pioneer Parkway, Peoria IL 61614, Phone 309-691-4840

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P.O. BOX 28810 - A
DALLAS, TEXAS 75228

Z–80 CPU CARD KIT FOR IMSAI/ALTAIR

$149. KIT

From the same people who brought you the $89.95 4K RAM kit. We were not the first to introduce an IMSAI/ALTAIR compatible Z–80 card, but we do feel that ours has the best design and quality at the lowest price.

The advanced features of the Z–80 such as an expanded set of 158 instructions, 8080A software compatibility, and operation from a single 5VDC supply, are all well known. What makes our card different is the extra care we took in the hardware design. The CPU card will always stop on an M1 state. We also generate TRUE SYNC on card, to insure that the rest of your system functions properly. Dynamic memory refresh and NMI are brought out for your use. Believe it or not, not all of our competitors have gone to the extra trouble of doing this.

As always, this kit includes all parts, all sockets, and complete instructions for ease of assembly. Because of our past experience with our 4K kit we suggest that you order early. All orders will be shipped on a strict first come basis. Dealers inquiries welcome on this item.

Kit shipped with 2 MHZ crystals for existing 500NS memory. Easily modified for faster RAM chips when the prices come down.

Z–80 Manual – $7.50 Separately.

Kit includes Zilog Manual and all parts.

JUMBO LED CAR CLOCK

$16.95 KIT

You requested it! Our first DC operated clock kit. Professionally engineered from scratch to be a DC operated clock. Not a makeshift kluge as sold by others. Features: Bowmar 4 digit .5 inch LED array, Mostek 50252 super clock chip, on board precision time base, 12 or 24 hour real time format, perfect for cars, boats, vans, etc. Kit contains PC Board and all other parts needed (except case). 50,000 satisfied clock kit customers cannot be wrong!

FOR ALARM OPTION ADD $1.50
FOR XFMR FOR AC OPERATION ADD $1.50

60 HZ CRYSTAL TIME BASE FOR DIGITAL CLOCKS
S.D. SALES EXCLUSIVE!

KIT FEATURES:

A. 60HZ output with accuracy comparable to a digital watch.
B. Directly interfaces with all MOS Clock Chips.
C. Super low power consumption. (1.5 ma typ.)
D. Uses latest MOS 17 stage divider IC.
E. Eliminates forever the problem of AC line glitches.
F. Perfect for cars, boats, campers, or even for portable clocks at ham field days.
G. Small Size, can be used in existing enclosures.

$5.95 or 2/$10.

KIT INCLUDES CRYSTAL, DIVIDER IC, PC BOARD PLUS ALL OTHER NECESSARY PARTS & SPECS

50HZ CRYSTAL TIME BASE KIT – $6.95

All the features of our 60HZ kit but has 50HZ output. For use with clock chips like the 50252 that require 50HZ to give 24 hour time format.

THIS MONTH'S SPECIALS!

SPECIAL *SPECIAL*

300.00 KHZ CRYSTAL – $1.50
8080A – CPU CHIP by AMD – $19.95
82S129 – 256 x 4 PROM – $2.50
N.S. 8865 OCTAL DARLINGTON DRIVERS 3 for $1.00
Z-80 – CPU by ZILOG – $69.95
MM5204 – 4K EPROM – $7.95

Prices in effect this month ONLY!

4K LOW POWER RAM BOARD KIT
THE WHOLE WORKS – $89.95

Imsai and Altair 8080 plug in compatible. Uses low power static 21L02–1 500ns. RAM's, which are included. Fully buffered, drastically reduced power consumption, on board regulated, all sockets and parts included. Premium quality plated thru PC Board.

7400–19c	7411–29c	7451–19c	7490–65c	74153–75c
74LS00–49c	7413–50c	7453–19c	74LS90–95c	74154-1.00
7402–19c	7416–69c	7473–39c	7492–75c	74157–75c
74LS02–49c	7420–19c	7474–35c	7493–69c	74161–95c
7404–19c	7430–19c	74LS74-59c	7495–75c	74164-1.10
74L04–29c	7432–34c	7475–69c	7496–89c	74165-1.10
74S04–44c	7437–39c	7476–35c	74121-38c	74174–95c
74LS04-49c	7438–39c	7480–49c	74123-65c	74181-2.50
7406–29c	7440–19c	7483–95c	74132-1.70	74191-1.25
7408–19c	7447–85c	7485–95c	74S138-1.95	74192-1.25
7410–19c	7448–85c	7486–45c	74141-75c	74193-1.00
TTL INTEGRATED CIRCUITS				74195–69c

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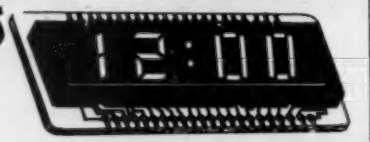

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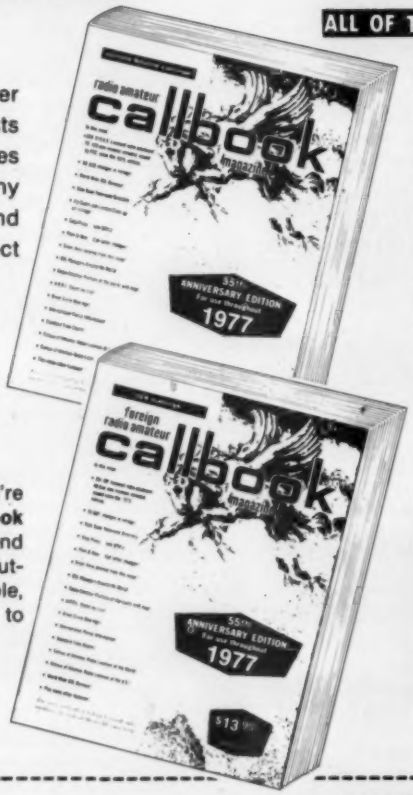

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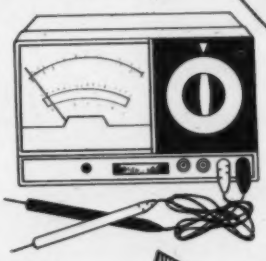

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Most Important — Complete Instructions, schematics Pictorials, layouts — everything for trouble free assembly

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KIT INCLUDES: P.C. Board Drilled & Silk Screened
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National MA1001A Digital Alarm Clock Module

including Power Supply

$9.95 complete

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- Brightness Cont. Cop.
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Split Time **$29.95 complete** Taylor Time

FEATURES:
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- 3.2768 MHz Crystal
- Variable Trimmer Cap.
- 2 mm slide & 3 MOM. PB Switches
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P.C. BOARD for above

Hand held case designed for above $3.95

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REQUIRES NO TOOLS

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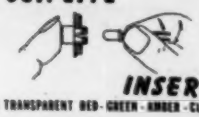

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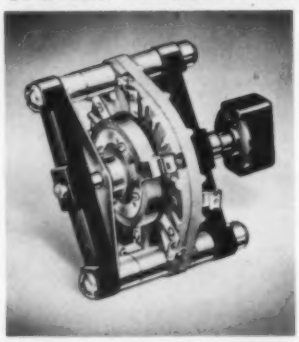

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10007B	1-5/8" 280 deg. CW	1.75
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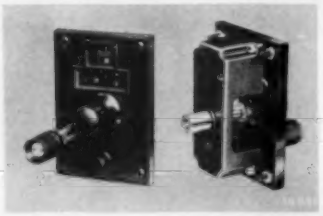
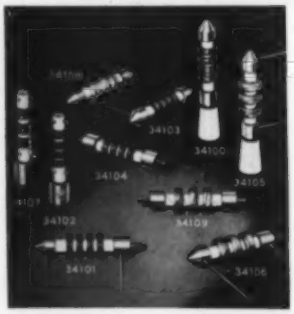
10039 $12.30

No. 10039 Small panel dial only 4" x 3 9/32". 7½:1 ratio. Scale is printed on vinylite and is easily removable for inking without disassembling the dial. The 10039 dial mounts easily on the front of panel with two No. 6-32 screws. Scale reads left to right. The knob is a standard Millen No. 10018 knob. Finish of bezel is black Ebonol. The bezel has blanks for mounting two extra controls which may be brought out through the dial face. The holes are to be drilled by the customer. The pointer is a deep non-paralax type.

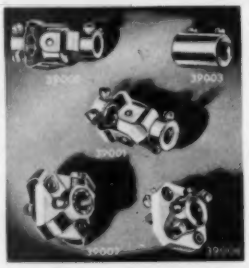
51000 HIGH VOLTAGE R-F SWITCHES
51001 — Single Wafer — 1 pole, 2 to 6 positions
13 KV. D.C. Flashover
20 Amperes
$21.20



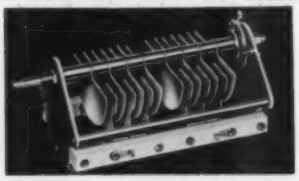
The No. 10031 Dial is a rugged turns counter dial. It has a 0-99 turn digital readout plus a vernier scale calibrated 0-100. The design includes a built-in dial lock. As shown below, the output coupling is a hub for ¼" diameter shaft. The crank handle drives any multiturn device directly. This new small size dial is designed to drive vacuum variable capacitors, rotary tunable inductors, multi-turn potentiometers, permeability tuned inductors and other multi-turn devices.
10031 COUNTER DIAL $25.50



Millen	Ind	Curr.	Price
34100	2.5 mH	250ma	$1.50
34101	2.5	250	1.40
34102	2.5	250	1.40
34103	2.5	250	1.40
34104	2.5	250	1.40
34105	1.0	300	1.55
34107	1.0	300	1.40
34108	1.0	300	1.40
34154	1.0	600	4.30
34156	2.5	500	5.30



Millen	Mat'l	Length	Voltage	Price
39001	Ceramic	1-5/16"	4000	$1.55
39002	Ceramic	13/16"	3000	1.55
39003	Brass	3/4"	None	1.00
39004	Brass	3/4"	None	1.55
39005	Brass	1-5/16"	None	1.55
39006	Ceramic	7/8"	3000	1.55
39016	Cycolac	9/16"	4400	1.55



VARIABLE CAPACITORS

Model	Max pf	Min pf	Spacing	Sections	Price
16250	255	20	.077"	2	$43.25
16520	203	40	.171	1	35.30
16520A	200	37	.077	1	24.75
19140	148	9	.022	1	12.00
19335	339	14	.022	1	14.90
26100RM	100	6	.015	2	10.20
26140RM	140	9	.015	2	12.00

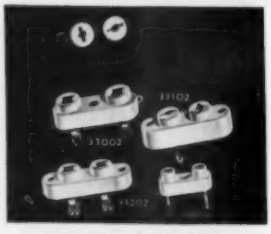
OTHER MILLEN ITEMS

A019	$0.90	31001	0.60
J300-10	1.30	31011	0.45
J300-25	1.30	32101	1.00
J300-33	1.30	33004	1.55
J300-68	1.30	33087-E	1.45
J300-100	1.30	33302-B	0.75
J300-300	1.30	34301-1	1.55
J300-500	1.50	36001	0.75
J300-1000	1.50	36002	0.80
J300-2500	1.80	37001-Blk.	1.80
J301-22	1.55	37001-Red	1.80
J302-10	3.30	37304	3.35
J302-500	3.30	37305	3.75
J302-1000	3.30	37501	1.80
J302-10,000	3.90	39016-A	1.85
J303-10	5.05	39032-B	2.60
10035	19.00	40305	1.55
10050	1.75	41305	1.90
10065	2.10	45004	1.20
16250	43.25	45005	1.20
16520A	24.75	69046	2.15
25035-E	10.10	69048	3.85

Add $2.00 Per Order Shipping.

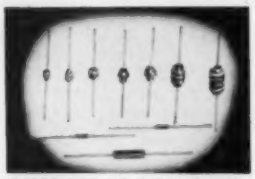
Send First Class Stamp For Flyer.

JAMES MILLEN MFG. CO., INC.



CRYSTAL SOCKETS

Millen	Size	Price
33002	.75"x.125"	$0.80
33102	.487x.095	.85
33202	.50 x.125	.85
33302	.487x.050	.65



34300 SERIES INDUCTORS
Net Price $1.05

Millen	Inductance (uH)
34300-2.5	2.5uH
34300-2.7	2.7
34300-10	10.
34300-25	25
34300-50	50
34300-68	68
34300-100	100
34300-500	500
34300-1000	1000
34300-2500	2500

6 Digit LED Clock Kit - 12/24 hr.

$9.95 ea. QTY. 12 OR MORE — $10.95 ea. QTY. 6-11 — $11.95 ea. QTY. 1-5

KIT INCLUDES
- •INSTRUCTIONS
- •QUALITY COMPONENTS
- •50 or 60 Hz OPERATION
- •12 or 24 HR OPERATION

6-LED Readouts(FND-359 Red, com. cathode)
1-MM5314 Clock Chip (24 pin)
13-Transistors
3-Switches
6-Capacitors
5-Diodes
9-Resistors
24-Molex pins for IC socket

LARGE .4" DIGITS!
ORDER KIT #850-4
AN INCREDIBLE VALUE!

"Kit #850-4 will furnish a complete set of clock components as listed. The only additional items required are a 7-12 VAC transformer, a circuit board and a cabinet, if desired."

Printed Circuit Board for kit # 850-4 (etched & drilled fiberglass) $2.95
Mini-Brite Red LED's (for colon in clock display) pkg. of 5 ..... 1.00
Molded Plug Transformer 115/10 VAC (with cord) 2.50
NOTE: Entire Clock may be assembled on one PC Board or Board may be cut to remote display.
Kit # 850-4 will fit Plexiglas Cabinet II.

6 Digit-LED Clock-Calendar-Alarm Kit

This is a complete, top of the line, Kit for the person that wants the best. Some of the many features and options are: 12/24 time, 28-30-31 day calendar, alternates time (8 sec) and date (2 sec) or can display time only and date on demand, 24 hr alarm - 10 minute snooze, alarm set indicator, 50/60 HZ. line operation or use with Xtal time base (#TB-1), built in OSC for battery back-up / AC failure, Aux. timer, CHOICE OF DIGITS.

Kit #7001B	**6 - .4" Digits**	**$39.95**
Kit #7001C	**4 - .6" Digits & 2-." [Seconds]**	**$42.95**
Kit #7001X	**6 - .6" Digits**	**$45.95**

Kits are complete (less cabinet) including PC boards, power supply, IC socket, 9 switches, 16 transistors and all parts required for above features and options **[All #7001 Kits Will Fit Cabinet I]**

MOBILE LED CLOCK

12 OR 24-HOUR OPERATION
12 VOLT AC or DC POWERED FOR FIXED OR MOBILE OPERATION.
SIX LARGE .4" DIGITS!

KIT OR ASSEMBLED

MODEL 2001

ACCURATE TIME WITH ADJUSTABLE XTAL TIME BASE

Approx. Size: 1¾"H x 4"W x 4½"D

BATTERY BACK-UP FOR POWER FAILURE OR TRANSPORTING FROM HOUSE TO CAR, ETC.

- 6 JUMBO .4" RED LED'S BEHIND RED FILTER LENS WITH CHROME RIM.
- SET TIME FROM FRONT VIA HIDDEN SWITCHES • 12/24-Hr. TIME FORMAT
- STYLISH CHARCOAL GRAY CASE OF MOLDED HIGH TEMP. PLASTIC
- BRIDGE POWER INPUT CIRCUITRY -- TWO WIRE NO POLARITY HOOK-UP
- OPTIONAL CONNECTION TO BLANK DISPLAY (Use When Key Off in Car, Etc.)
- TOP QUALITY PC BOARDS & COMPONENTS - EXCELLENT INSTRUCTIONS
- MOUNTING BRACKET INCLUDED

KIT #2001 COMPLETE KIT (Less 9V. Battery) **29.95 EA.** — 3 OR MORE **$27.95 EA.**

115 VAC Power Pack #AC-1 **$2.50 EA.**

ASSEMBLED UNITS ORDER #2001 WT WIRED FOR 12 vdc OP IF NOT SPECIFIED OTHERWISE — WIRED & TESTED (LESS 9V. BATTERY) **$39.95 EA.** — 3 OR MORE **$37.95 EA.** Assembled Units May Be Mixed With Kits for Qty. Price

CPU

$19.95 ea.
NS8080AD
Micro Processor Chip
Prime National LSI
40 Pin socket
$.50 with each 8080A!

450 ns MEMORY
Fairchild 1K Ram
low, low, low power.

2102L1PC	$1.95ea.
25-99	$1.75 ea.
100-199	$1.60 ea.
200 or more	$1.45 ea.

JUMBO RED LED's 12/$1.00 50/$3.95

PRINTED CIRCUIT BOARDS for CT-7001 Kits sold separately with assembly info. PC Boards are drilled Fiberglass, solder plated and screened with component layout. Specify for # 7001B or # 7001C (Set of 2) $7.95

JUMBO DIGIT CLOCK KIT

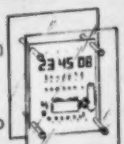
A complete Kit (less Cabinet) featuring: six .5" digits, MM5314 IC, 12/24 Hr. time, 50/60 HZ., Plug-Transformer, Line Cord, Switches, and all Parts.
[Ideal Fit in Cabinet II]
Kit #5314-5 ..... **$19.95 ea. 2/$38.**

JUMBO DIGIT CONVERSION KIT

Convert small digit LED clock to large .5" displays. Kit includes 6-.5" LED's, Multiplex PC Board & easy hook-up info.

Kit #JD-1CC For common Cathode
Kit #JD-1CA For common Anode
$9.95 ea. 2/$19.

SEE THE WORKS Clock Kit
Clear Plexiglas Stand



- •6Big .4" digits
- •12 or 24 hr. time
- •3 set switches (back)
- •Plug transformer
- •all parts included

Plexiglas is Pre-cut & drilled
Size: 6"H, 4½"W, 3"D

A SUPER LOOKING CLOCK!
Kit #850-4 CP **$23.50 ea. 2/$45.**

Fairchild Super Digit FND-359

4" Char. Ht. 7 segment LED RED Com. Cath. Direct pin replacement for popular FND-70.
95¢ ea, 10/$8.50 100/$79.00

SET OF 6 FND-359 WITH MULTIPLEX PC BOARD $6.95

25 AMP BRIDGE

$1.95 ea. 3/$5.00
100 PIV

TELEPHONE FORMAT KEYBOARD
BY Chomerics

2-1/4"x3" 5/32" thick
$4.95 6/$28.

SCHOTTKY TTL

74S00	$ .35
74S01	.40
74S04	.55
74S05	.60
74S08	.55
74S10	.40
74S20	.50
74S22	.45
74S40	.45
74S50	.45
74S51	.55
74S60	.85
74S64	.55
74S74	.85
74S75	1.75
74S78	1.50
74S86	.95
74S107	.95
74S112	.95
74S113	1.40
74S114	.95
74S133	.75
74S134	.75
74S136	1.75
74S139	1.50
74S151	1.95
74S153	1.95
74S155	1.95
74S156	1.95
74S157	1.80
74S158	2.50
74S174	2.50
74S175	2.50
74S181	2.95
74S182	1.95
74S251	2.75

DTL

930	$ .09
932	.09
937	.09

LED DRIVERS

7447	$ .95
7448	.95
75491	.65
75492	.65

VOLTAGE REGULATORS

LM309 H	TO-5	$ .95
LM309 K	TO-3	1.25
7805	TAB	.95
7812	TAB	1.25
7815	TO-3	1.25
7815	TAB	1.25
78L 15	TO-5	.75
LM340T-18	TAB	1.25
LM340T-24	TAB	1.25
7824	TO-3	1.25
723	DIP	.75
723	TO-5	.75

DIGITAL CLOCK IC's

MM5312	$ 4.95
MM5314	3.95
MM5375 AB	3.95
CT-7001	7.95
CT-7002	13.95
50380	3.95
MM 5369	2.50

XTAL
3.579545 MHZ. $ 1.95

PRESCALE

11C90DC	$15.95
95H90	9.95

DIODES

IN 4002	1A, 100 PIV	12/$1.00
IN 4005	1A, 800 PIV	11/$1.00
IN 4007	1A, 1000 PIV	10/$1.00
RECTIFIER	2.5A, 1000 PIV	4/$1.00
IN 914	SIL. SIGNAL	20/$1.00
IN 4148	(1N914 Equiv.)	20/$1.00
DYAC	28V.	4/$1.00

PLUG TRANSFORMERS

12VAC at 150 MA	$2.50
12VAC at 500 MA	3.50
7 VAC at 1.75VA	2.50

LINEAR

555 TIMER	2/$1.00
556 DUAL TIMER	.95
565 PLL	.95
566 FUNCTION GEN.	1.75
567 TONE DECODER	1.75

IC SOCKETS

PINS	1-24	25	100
8	$ .25	$ .22	$ .20
14	.25	.22	.20
16	.28	.25	.23
18	.31	.28	.26
24	.50	.45	.40
28	.60	.55	.50
40	.75	.70	.65

COMPUTER

8080A	CPU	19.95
1702	E Prom	8.95
5203	E Prom	8.95
2102L1PC	1K Ram	1.95

EXAR

XR 2556	$ 1.75
XR 2567	$ 1.95

TRANSISTORS

2N2222	TO-18	5/$1.00
2N2554	TO-5	2/$1.00
2N2712	TO-98	5/$1.00
2N3415	TO-92	5/$1.00
2N3704	TO-92	5/$1.00
2N4400	TO-92	5/$1.00
2N4125	TO-92	5/$1.00
2N4249	TO-92	5/$1.00
2N4437	TO-92	5/$1.00
2N6027	PUT	2/$1.00
2N5457	N J-Fet	2/$1.00

SWITCHES

ROCKER SPDT	6/$1.
MINI-SLIDE SPDT	5/$1.
REG. SLIDE DPDT	6/$1.
PUSH BUTTON N.O.	3/$1.
MINI TOGGLE SPDT	$1.30
MINI TOGGLE DPDT	1.50

TRANSISTOR SOCKET TO-5/18 GOLD PINS 5/$1.00

NYLON WIRE TIES
8" TIE-WRAP 100/$1.95
4" TIE-WRAP 100/$1.75

MOLEX PINS
REEL OF 1000 $ 8.50
STRIP OF 100 1.25

MISC. PRIME IC's

FAIRCHILD 9316	(74161)	$ .95
75234 DUAL CORE SENSE AMP		1.50
MM 502H TO-5 SHIFT REG		.95

OP AMPS

3/$1.00	
301	TO-5
308	DIP
709	TO 5
741	DIP
741	M-DIP
741	TO-5
747	DIP
748	DIP

DISCRETE LED's
JUMBO RED
12/$1.00
50/$3.95
100/$7.50

PC TRIM POTS
25K 6/$1.00
4.7K 6/$1.00

SPECTROL 10K 10 TURN 89¢ 4/$3.00

7-SEG LED

COMMON CATHODE

	COLOR	HT. DEC PT. PR.	EA
FND-359	RED	.4" RHDP	$ .95
FND-503	RED	.5" RHDP	$1.35
DL-750	RED	.6" LHDP	$1.95
XAN-654	GREEN	.6" NDP	$1.95
XAN-664	RED	.6" NDP	$1.95

COMMON ANODE

DL-747	RED	.6" LHDP	$1.95
MAN-72	RED	.3" LHDP	$1.25
XAN-81	YELLOW	.3" RHDP	$1.75
XAN-351	GREEN	.3" RHDP	$1.50
XAN-361	RED	.3" RHDP	$1.50
XAN-362	RED	.3" LHDP	$1.50
XAN-662	RED	.6" NDP	$1.95
XAN-692	RED	.6" NDP	$1.95

Form Inexpensive Sockets 100 for $1.25 Reel of 1000 - $8.50 — MOLEX PINS

60 HZ. XTAL TIME BASE KIT

Will enable Digital Clock or Clock-Cal. Kits to operate from 12VDC. Uses MM5369 and 3.58MHZ. XTAL. Req. 5-15VDC/2.5 MA. 1"x2" PC Board. Easy 3 wire hookup. Accuracy: + - 2 PPM

#TB-1 [adjustable]
Complete kit $4.95 ea
Wired & Cal. $9.95 ea

PLEXIGLAS CABINETS

Black, White or Clear Cover

Great for Clocks or any LED Digital project. Clear-Red Chassis serves as Bezel to increase contrast of digital displays.

$6.50 ea. 2/$12. ANY SIZE/ COLOR

CABINET I
3" H, 6¼" W, 5½" D

CABINET II
2½" H, 5" W, 4" D

3"x6"x1/8" RED OR GREY PLEXIGLAS FOR DIGITAL BEZELS **95¢ ea. 4/$3**

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WE PAY ALL SHIPPING IN CONTINENTAL USA — OTHERS ADD 5% [10% FOR AIRMAIL]

I/O EDITORIAL

from page 68

came out to an average of $2032 per ... about what your shopping list will indicate. If that seems like a lot of money to you, then it is probably time for you to think seriously in terms of making your hobby pay off ... perhaps by writing articles for one of the ham magazines. Ahem.

By way of throwing some further rocks in your path, I think you probably should not know that most of the fellows with going computer systems are planning to spend a bit more on them this coming year. Hold tight ... the estimate of planned spending is also right around $2000. I suspect that those with running systems are now convinced that they really want to have a floppy disk to go with their machine ... or perhaps a dual floppy. If you do decide to go the floppy route, be sure to check on the programs available ... the disk and disk controller are the easy part; you still need a good disk operating system (DOS) and without it you are again up aforesaid creek. I know where you can buy a multimegabyte disk system, complete with an Altair compatible controller, for a few hundred dollars. All you have to do is write your own DOS ... I forget how many man years IBM spent on a DOS recently.

We'll be having more and more ham oriented operating systems in *73*. If you've worked up any, please send them in for all of us to enjoy. You'll have to read *KB* for most of the non-ham programs ... and we'll have a lot of them.

While the above probably has not galvanized you into anything but inaction, I did think I should level with you as to the honest state of the field of microcomputers. On the positive side, I'm in touch with thousands of computer hobbyists and they are having the time of their lives. A surprising percentage of them are hams and you can bet they will be doing a lot of ham stuff via microprocessor. Sit tight if you want, but you are missing out on fun. These are days that will never come again and those who are there will never regret it.

Corrections

A correction for my article "Superprobe," in the Holiday issue, on page 92 and 93. Resistor R9 is shown incorrectly installed from pin 3 of IC2 to ground, and should be moved to the other side of the capacitor C3, or from pin 5 of IC2 to ground. If wired as shown, the symptom will be that the pulse LED will remain lit at all times.

C. W. Andreasen WA6JMM
Van Nuys CA

In "Mobile Smokey Detector" (Holiday *73*, page 32), it was stated that since power levels are below 100 mW, it might not be necessary to have a ham license to operate in the 10.5 GHz band. This was incorrect. The band requires a license for any power.

The CT7001 IC described in December's "CT7001 Clockbuster" is no longer available from Cal-Tex Semiconductor. Fairchild Semiconductor is manufacturing the IC under the designation FCM7001. They are available from *James Electronics, 1021 Howard Avenue, San Carlos CA 94070* for $7.00.

Our apologies for failing to mention that the author of "A 60 Foot Antenna on a 20 Foot Lot" (Holiday issue, 1976, p. 138) was Norman Rossignol WB6DPR. The editors extend their apologies for the error. The article first appeared in *World Radio News*, January, 1976.

Please be kind enough to publish the following correction and addition to my February, 1976, article "Put Your SB-10 on 160m."

Because of the inexactness of the method of extrapolation I used, the value of the phase shift capacitors that I stated to be 1240 pF should be corrected to 1744 pF. Since 50 Ohm phase shift resistors are used to produce 45 + 45 = 90 degrees shift the following formulas may be used to calculate the phase shift capacitors:

$$Xc = 50 \text{ Ohms}$$

$$= \frac{1}{2\pi FC}$$

$$= \frac{1}{(6.28)\,(1.825)\,(10^6)\,C}$$

$$C_{pF} = C_F\,(10^{12})$$

$$= \frac{(1)\,(10^{12})}{(6.28)\,(1.825)\,(10^6)\,(50)}$$

$$= 1744 \text{ pF}$$

The use of 1744 pF capacitors will result in maximum SB suppression in the SB-10. In addition, one should add a 50 pF capacitor is parallel with the output connector on the unit to resonate the SB-10 output as a pi network. As Leeds Radio Co. no longer supplies these capacitors, they may now be obtained from Cap Electronics, 134 Duane St., New York NY 10013.

Arthur Eckman WA2ECI
New York NY

propagation

by
J. H. Nelson

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7	7	3	3	3	3	3	7	7A	14	14
ARGENTINA	14	7	7B	7	7	7	14	14	14	14	14A	14
AUSTRALIA	14	7B	7B	7B	7B	7	3A	7	14	14	14	14
CANAL ZONE	14	7	7	7	7	7	7A	14	14	21	14	14
ENGLAND	7	3A	3	3B	3B	7	7A	14	14	14	7A	7
HAWAII	14	7B	7	7	7	7	3A	3A	7B	14	14A	14
INDIA	7	7	7	3B	3B	3B	7A	14	7A	7B	7	7
JAPAN	14	7B	7B	3B	3B	3	3	7	7	7B	7B	14
MEXICO	14	7	7	7	7	7	7	14	14	14A	14	14
PHILIPPINES	14	7B	7B	7B	7B	3B	7	7	7	7B	7B	7A
PUERTO RICO	7	7	7	7	3A	3A	14	14	14	14	14	14
SOUTH AFRICA	7A	7	7	7	7B	7B	14	14	21	14A	14	14
U. S. S. R.	7	7	3	3	7	7	7B	14	14	7B	7B	7
WEST COAST	14	7	7	7	7	7	7	7A	14	14	14A	14

CENTRAL UNITED STATES TO:

ALASKA	14	7A	7	3	3	3	3	3	7	14	14	14
ARGENTINA	14	7A	7B	7	7	7	7	14	14	14	14A	14
AUSTRALIA	14A	14	7B	7B	7	7	7	7	7A	7A	14	14
CANAL ZONE	14	7A	7	7	7	7	7	14	14	21	14A	14
ENGLAND	7	3A	3	3B	3B	3B	7	7A	14	14	7B	7
HAWAII	14A	14	7	7	7	7	7	3A	7	14	14	14A
INDIA	7	7	7B	3B	3B	3B	3B	7A	7A	7	7	7B
JAPAN	14	7A	7B	3B	3	3	3	3	7	7	7B	14
MEXICO	14	7	7	3	3A	3	3	7	14	14	14	14
PHILIPPINES	14	14	7B	7B	3B	3B	3	7	7	7	7B	7A
PUERTO RICO	14	7	7	7	7	7	7	14	14	14A	14	14
SOUTH AFRICA	14	7	7	7	7B	7B	7B	14	14	14A	14	14
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ENGLAND	7	3	3	3B	3B	3B	3	7	14	14	7B	7B
HAWAII	21	14A	14	7	7	7	7	3A	7	14	14	14A
INDIA	7B	14	7B	3B	3B	3B	3B	3A	7	7	7	7B
JAPAN	14	14	7B	7B	3	3	3	3	7	7	7B	14
MEXICO	14	7A	7	7	7	7	7	7	14	14	14A	14
PHILIPPINES	14	14	7A	7	3B	7B	7B	3	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	7	14	14	14A	14A	14
SOUTH AFRICA	14	7	7	7	7B	7B	7B	7B	14	14A	14	14
U. S. S. R.	7	3	3	3	3	7	7	7A	7A	7	7B	7B
EAST COAST	14	7	7	7	7	7	7	7A	14	14	7A	14

A = Next higher frequency also may be useful
B = Difficult circuit this period
F = Fair
G = Good
P = Poor

FEBRUARY

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
		1 F	2 P	3 P	4 F	5 G
6 G	7 F	8 F	9 P	10 G	11 G	12 G Lincoln's Birthday
13 F	14 G St. Valentine's Day	15 G	16 G	17 G	18 G	19 G
20 G	21 G Washington's Birthday	22 G	23 F	24 P	25 F	26 F
27 G	28 G					

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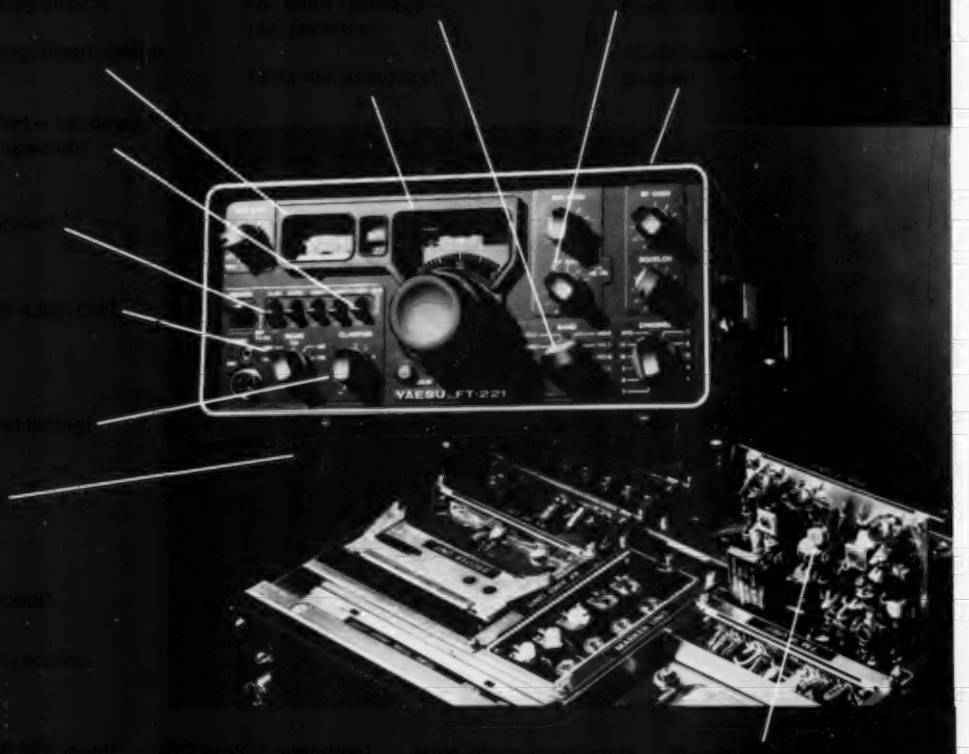

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